Trouble-shooting instructions : VWW-5009

BOSCH system : Motronic (Digifant)

Make of vehicle : VOLKSWAGEN

Basic microcard : PKW-046

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

VW Passat (04.88 ->)
with 1.8 l / 4-cyl. engine
with and without lambda closed-loop control

Special features:

* 79 kW (107 bhp) engine, code letters "PF" with lambda closed-loop control
* 82 kW (111 bhp) engine, code letters "PB" without lambda closed-loop control

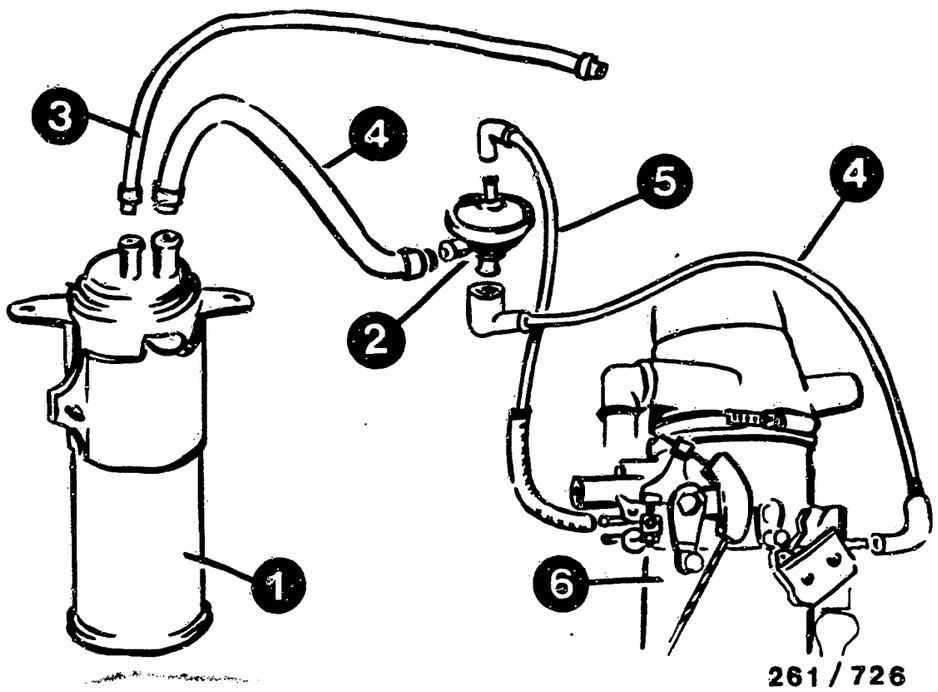
* Control unit with 25-pole connector

* Crankshaft speed and position detected by way of "Hall generator" (no engine-speed and reference-mark sensor)

* Idle-speed regulation

* Knock control

* New: Fuel-pump run-on function for improved hot starting (external control unit)



261/726

1 = Active-carbon container
2 = Tank ventilation valve
3 = Tank ventilation line
4 = Scavenging line (suction hose)
5 = Vacuum connection
6 = Throttle-valve assembly

SPECIAL FEATURES (continued)

Tank ventilation system:
Vehicles featuring lambda closed-loop control are fitted with a closed tank ventilation system. The fuel vapors released in the fuel tank are routed through the tank ventilation line into the active-carbon container where the fuel vapors enter the active-carbon fill. The task of the tank ventilation valve is to route the fuel vapors stored in the active-carbon container to the combustion chamber when driving.
The tank ventilation valve closes off the scavenging line when the engine is not running and when idling. The tank ventilation valve opens at increased speed (vacuum actuation).

SPECIAL FEATURES (continued)

Testing fuel-pump run-on:

* Connect fuel pressure gauge and let engine run (reading approx. 2.5 bar)

* Switch off ignition and test resistance of fuel pressure switch (next to injection valves): Set value approx. 0 Ω (leave plug open)

* Detach 1-pole connector of thermo-switch for radiator-fan run-on (at cylinder head, in vicinity of intake manifold) and connect to ground: radiator fan must run.

* Re-connect fuel-pressure-switch plug

* Switch ignition on and off again

* Fuel pump must run after approx. 2 – 3 minutes

* Re-attach connector of thermo-switch for fan run-on:
Fuel pump must no longer run.

* Resistance of fuel pressure switch must be infinity (no continuity) at fuel pressures below approx. 1.2 bar.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel and high-voltage flashovers when testing the compression.
Therefore, disconnect Motronic relay.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)
1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

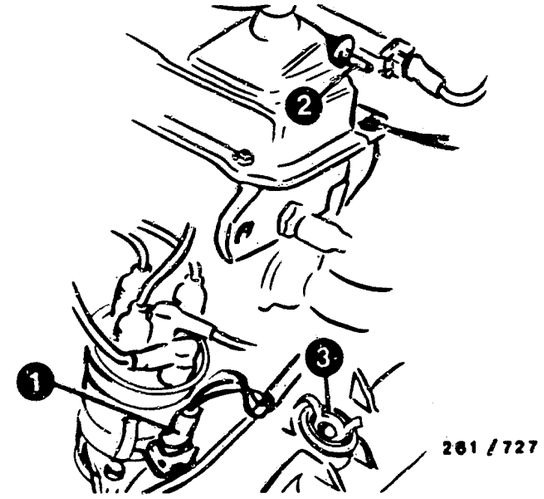
1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
*											Voltage at control unit
*				*							Magnetic pulse generator
*		*			*	*					Fuel pressure
				*	*						Fuel delivery
*	*										Fuel-pump run-on
*		*				*	*				Solenoid-operated injection valves
		*			*						Throttle valve
		*	*		*						Throttle-valve switch
		*									Overrun cutoff
	*	*	*								Idle actuator
		*									Idle speed, CO
*	*	*	*								Air-intake system
*	*	*	*	*	*	*					Air-flow sensor
					*	*					Temperature sensor (air)
*	*	*	*	*	*	*					Temperature sensor (engine)
			*		*	*		*			Knock sensor
*		*		*	*						Ignition coil
*		*	*	*	*						Primary signal
		*	*	*	*	*					Secondary pattern
*	*	*	*		*	*	*	*	*		Ignition angle
		*	*	*							Interference-suppression resistors
				*	*						Interference
	*	*	*				*				Tank ventilation
		*	*								Lambda closed-loop control
*	*	*	*	*	*	*		*	*		Control unit

RAPID DIAGNOSIS CHART

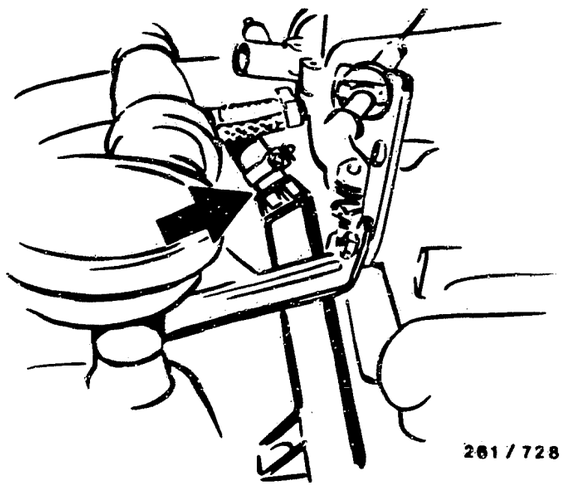
Test step	Testing of component/function	Test instructions/ test conditions	Control-unit terminals	Set values
1	Leads to magnetic pulse generator (Hall generator)	Disengage gear, switch off ignition, detach Digifant control unit and control unit of idle-speed regulator as well as pump relay. Detach plug at ignition distributor and jump all three connections. Measure resistance with test prods at open control-unit plug (25-pole). Caution: take care not to damage spring contacts!	8<=> 6 and 18<=> 6	Approx. 0 Ω (continuity)
2	Temperature sensor Intake air	Resistance at +15...+30°C:	9<=> 6	1,45...3,3 k Ω
3	Temperature sensor Coolant	Resistance at +15...+30°C: with engine at operating temperature:	10<=> 6	1,45...3,3 k Ω 280...360 Ω
4	Throttle-valve switch Idle contact	Accelerator pedal not pressed: Accelerator pedal slightly depressed (part-load range):	11<=> 6	Approx. 0 Ω (continuity) Greater than 1 M Ω
5	Throttle-valve switch Full-load contact	Press accelerator pedal as far as it will go (full-load stop): Slowly release accelerator pedal:	11<=> 6	Approx. 0 Ω (continuity) Greater than 1 M Ω
6	Air-flow sensor (Overall resistance)	Measure resistance:	17<=> 6	500...1100 Ω
7	Air-flow sensor (Wiper)	Slowly deflect air-flow sensor flap as far as it will go:	21<=> 6	8...2500 Ω
8	Injection valves (4)	Winding resistance at +15...+30°C: Note: All valves in parallel	12<=>14	3,7...5,0 Ω
9	Lead to lambda sensor	Disconnect lambda-sensor plug connection: Connect lambda input (black lead to control unit) to ground:	2<=>13	Greater than 1 M Ω Approx. 0 Ω (continuity)
10	Heater winding of lambda sensor	Measure resistance:	14<=>13	1...15 Ω (temperature-dependent)

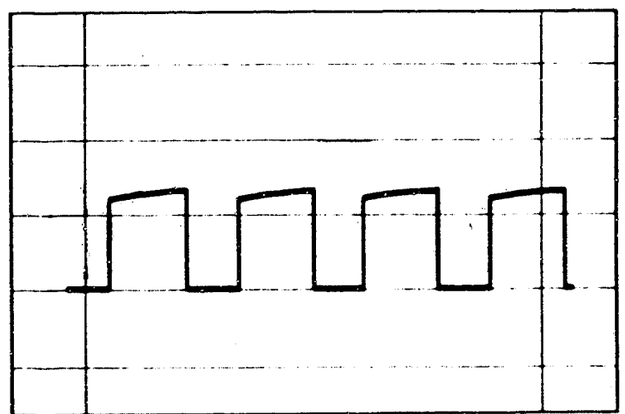
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit term-inals	Set values
11	Voltage measurement, switch over measuring range Main relay + supply leads; voltage supply of control unit. Switch on ignition:	14, 13 and 14, 19	10...15 V
12	Pump relay + supply leads; activation of electric fuel pump. Switch on ignition:	3, 13	10...15 V
13	Fuel pressure Switch off ignition, connect pressure gauge: -to fuel-distribution pipe, if V.A.G 1318/1 adapter fitted (upper illustration Item 2) or -to fuel inlet with Y connecting piece (center illustration, arrow). Switch on ignition, bridge term. 3 and term. 13 in the control-unit plug. Electric fuel pump must start to run audibly:	———	2,8...3,2 bar
14	Lead to term.50 (starting motor). Start signal. Shift into neutral and start:	1, 13	8...15 V
15	Ignition coil (primary winding) with supply leads, as well as connection from control unit term. 25 to ignition trigger box term. 6 (bridge term. 6 and term. 1 in 7-pin plug). Switch on ignition:	25, 13	10...15 V
16	Digifant control unit. Supply voltage of magnetic pulse generator. Connect control unit, push back rubber sleeve of plug on ignition distributor (upper illustration Item 1). Measure voltage at the two outer leads (+ and -) using test prods. Switch on ignition:	8, 6	10...15 V
17	Magnetic pulse generator, switching. As previously, however, test the voltage characteristic using oscilloscope (special input at the center connection (0) and vehicle ground. Start engine:	18, 6	See lower illustration



261/727


261/728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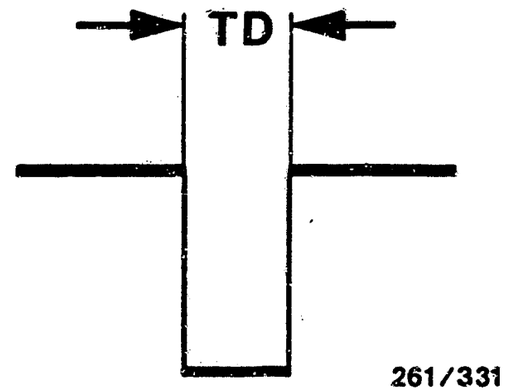
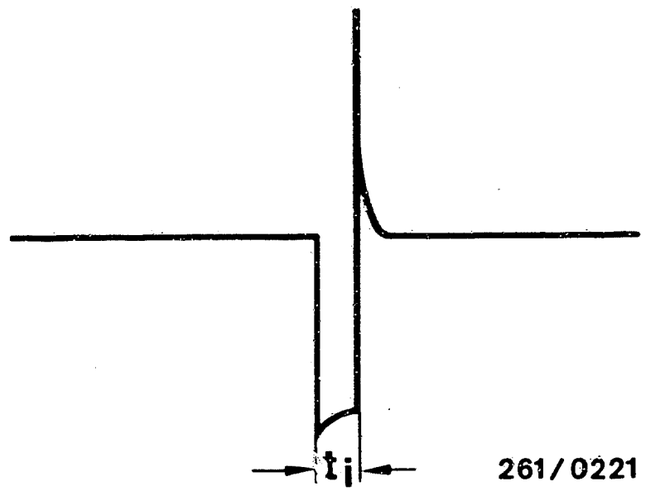
RAPID DIAGNOSIS CHART (Continued)

Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit ter-minals	Set values
18	Dwell-period signal Using oscilloscope (special input), test at ignition trigger box term. 6 and term. 2 (push back rubber sleeve). Shift into neutral and start.	25, ground	See upper illustration
19	Injection signal Using oscilloscope, test at common injection-valve plug (lower illustration, Item 2) (test lead 1 684 463 093). Shift into neutral and start.	14, 12	See center illustration
20	Voltage supply of air-flow sensor Push back rubber sleeve on air-flow-sensor plug and measure voltage between terminals 3 and 4 using test prods. Swith on ignition.	17, 6	Greater than 4,5 V
21	Air-flow sensor (wiper) As above, however, measure between terminals 2 and 4.	21, 6	Air-flow-sensor flap in rest position: 0,2...0,3 V Deflect air-flow-sensor flap fully: greater than 4,2 V
22	Overrun cut-off Start engine, increase engine speed to approx. 2000 min. $^{-1}$ and actuate full-load contact (lower illustration, Item 6) or idle contact (both contacts connected in parallel).	——	Engine (at normal operating temp.) hunts
23	Leads to knock sensor Pull apart plug-in connection to knock sensor and bridge all three connections in the plug. Measure resistance in the control-unit plug:	5, 4 and 7, 4	Approx. 0 Ω (continued)



261/331



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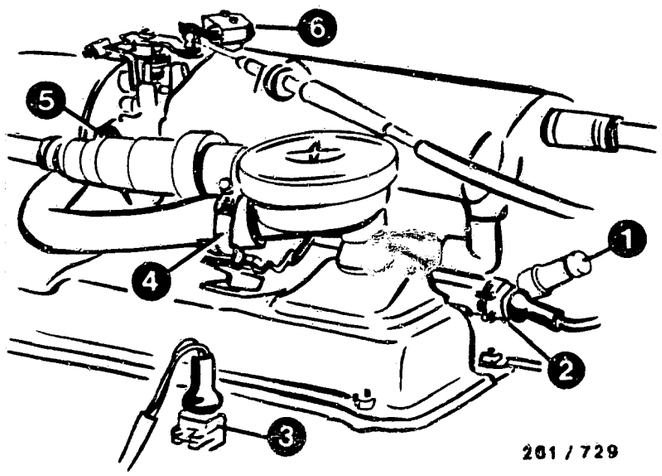
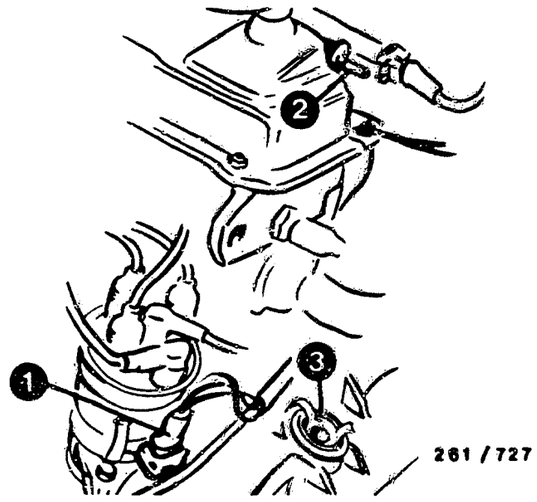


261/729

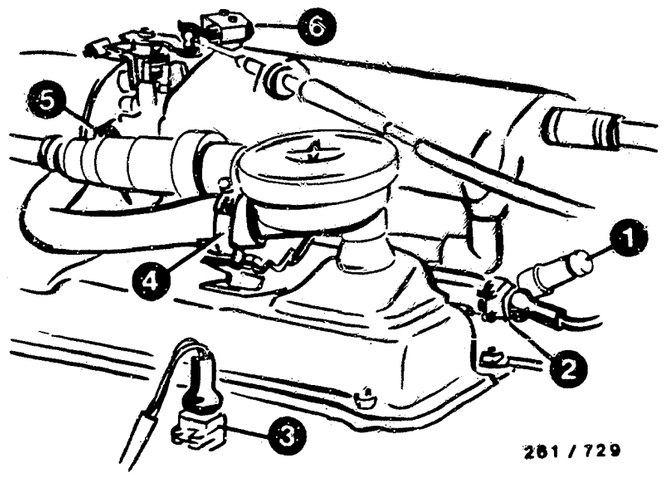
RAPID DIAGNOSIS CHART (continued)

Test step	Testing of component/function Test instructions/test conditions	Control-unit terminals	Set values
24	Test ignition angle (basic value). Engine at operating temperature, plug of temperature sensor (engine) detached. Engine speed 2000...2500 min $^{-1}$:	——	Basic value 4...8 ° crankshaft
	Attach plug of temperature sensor (engine) again, engine speed approx. 2300 min $^{-1}$. Subtract basic value from ignition angle indicated and determine adjustment value:		Adjustment value 27...33 ° crankshaft
	Note: If adjustment value approx. 10° crankshaft smaller than set value, test knock sensor (see "Test specifications") and determine ignition angle again. Renew knock sensor if necessary.		
25	Idle speed and CO. Connect engine and CO tester (with catalytic converter at CO measuring tube). Engine at operating temperature, loads switched off, detach and seal hose for crankcase breather. Allow engine to idle for approx. 1 min., then detach temperature sensor (engine), accelerate 3 times and measure idle speed/CO. Note: values must remain within tolerance after connecting temperature sensor.	——	750...850 min $^{-1}$ (applies to all) Without lam. cl.-lp. cont. 0,5...1,5 vol.%CO With cl.-lp. control 0,3...1,1 vol.%CO
26	Idle-speed regulation Measure idle-actuator current. Idle speed, engine at operating temperature, loads switched off. Temperature sensor (engine) disconnected: Temperature sensor (engine) connected: Connect loads (e.g. headlights, A/C etc.):	——	 approx. 420±30 mA approx. 420±30 mA fluctuating depending on load 400...1000 mA



261/727

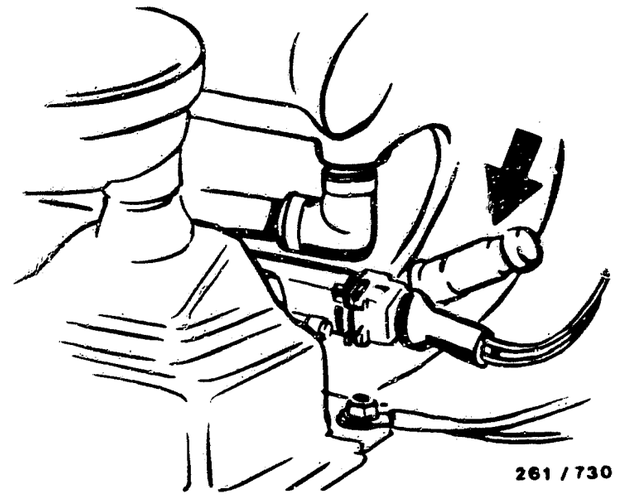
1= Plug on magnetic pulse generator
2= Pressure-gauge connecting point on fuel-distribution pipe
3= Ignition point or TDC marking (remove cap)



261/729

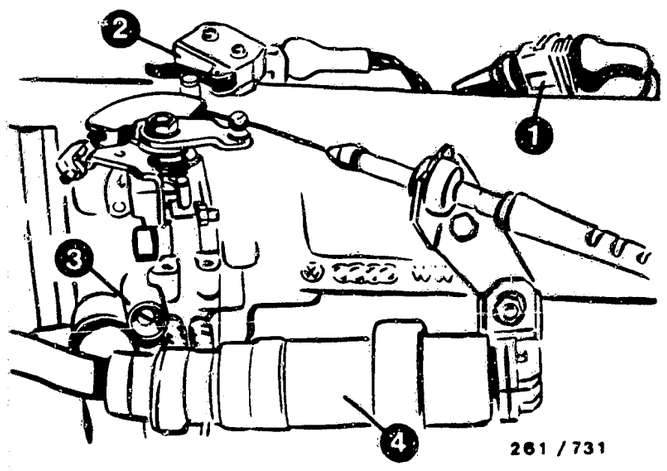
1= CO measuring tube on Cat
2= Common injection-valve plug
3= Temperature sensor (engine)
4= Crankcase breather
5= Idle-speed adjusting screw
6= Full-load switch

Test step	Testing of component/function Test instructions/conditions	Ctrl.-unit term-inals.	Set values
26	Upper limit of lambda closed-loop control. CO analyzer upstream of the catalytic converter (to CO measuring tube). Idle speed; engine and catalytic converter at normal operating temperature; pull apart plug-in connection to lambda sensor and apply connection on control-unit side (black lead) to ground.	——	CO rises above 1,1 % by vol. (Conduct test step rapidly)
27	As Test step 26, however, test lower limit of lambda closed-loop control. Apply lambda input to approx. +2V, e.g. to positive terminal of a 1.5 V monocell (connect negative terminal to vehicle ground).	——	CO drops below 0,3 % by vol. (rough idling)
28	Control limit and lambda sensor in closed-loop-control mode. Plug-in connection to lambda sensor connected up; run engine (at normal operating temp-erature) at idle; note down CO values: Disconnect air hose from fuel-pressure regulator and seal off:	——	CO= 0,3...1,1 % by vol. CO rises briefly and drops back to control value above



Arrow = CO measuring tube on Cat

1 = Lambda-sensor plug-in connection
2 = Full-load switch
3 = Idle-speed adjusting screw (Basic setting)
4 = Idle actuator



Idle-speed adjustment
* Idle speed: 800 ± 50 min $^{-1}$

Exhaust-gas adjustment
* CO value when idling with eng. at operating temperature
  Version without lambda closed-loop control: 1,0 ± 0,5 vol. %
  Version with lambda closed-loop control (1) : 0,7 ± 0,4 vol. %
  (1) = Measured at CO measuring tube

Pressure regulator
* Fuel pressure: 3,0 ± 0,2 bar

Electric fuel pump
* Delivery (measured in return line)
  Fuel pump: min. 500 cm ^{3} /30s
* Supply voltage
  (under load): min. 12 V

Temperature sensor (engine) (blue plug)
* Internal resistance at ambient temperature
  (+15°C...+30°C): 1,45...3,3 k Ω
  with engine at operating temperature
  (approx. +80°C): 280...360 Ω

Solenoid-operated injection valve
* Internal resistance at ambient temperature
  (+15°C...+30°C): 15...17,5 Ω

Idle actuator
* Internal resistance: approx. 4 Ω

Knock sensor
* Internal resistance: greater than 1 M Ω
  Tightening torque: 15...25 Nm
  (loosen screw first when checking)

Fuel pressure switch for fuel-pump run-on
* Internal resistance at
  Fuel pressure below 1.2 bar: greater than 1 M Ω
  Fuel pressure above 1.2 bar: approx. 0 Ω

Air-flow sensor
* Internal electrical resistance
  between term.2 and term.4: 8...2500 Ω (1)
  term.3 and term.4: 500...1100 Ω

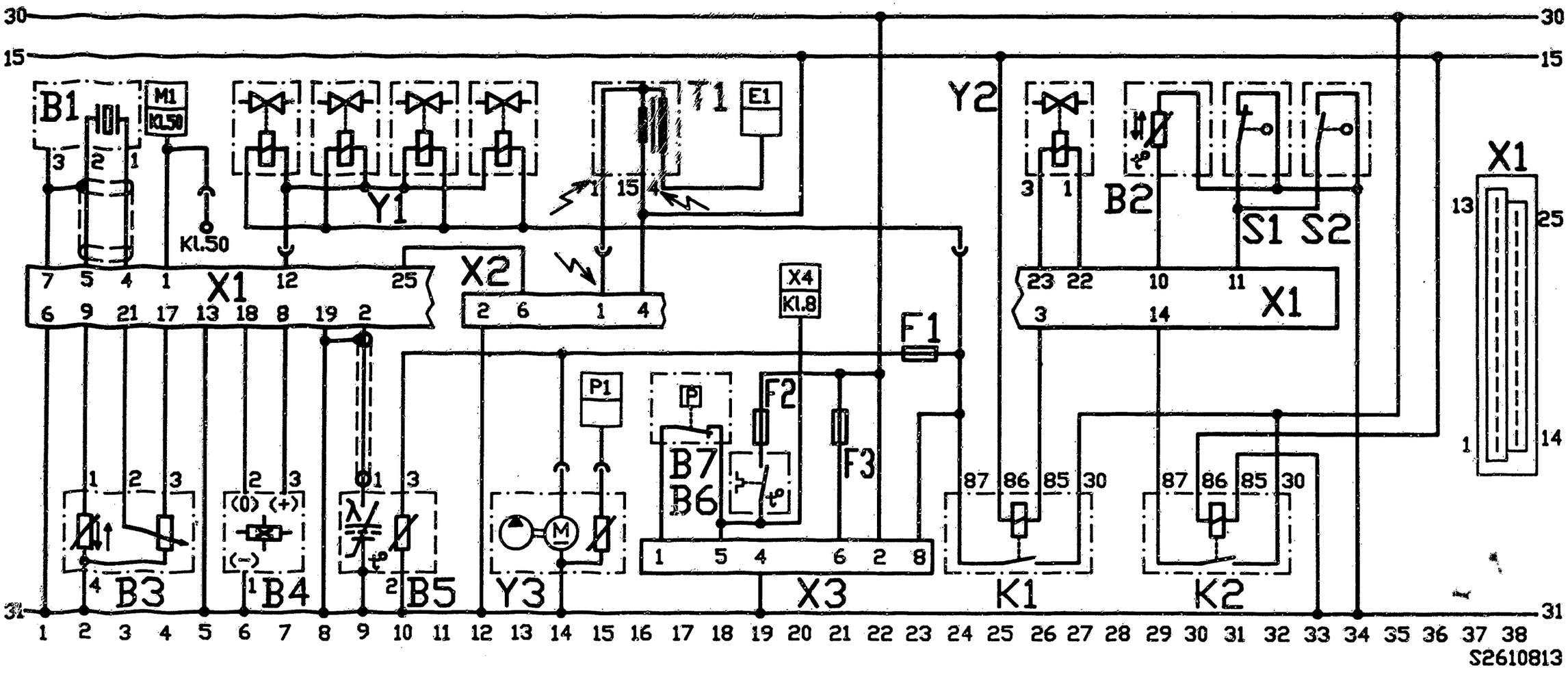
  (1) = (Deflect air-flow sensor flap as far as it will go).

Temperature sensor (intake air)
* Internal electrical resistance
  measured at air-flow sensor
  between term.1 and term.4
  at ambient temperature
  (+15°C...+30°C): 1,45...3,3 k Ω

Ignition coil
* Primary resistance
  (term.1/term.15): 0,6...0,8 Ω
* Secondary resistance
  (term.1/term.4) : 6,9...8,5 k Ω

Lambda-sensor heater winding: 1... 15 Ω

Interference-suppression resistors
* Ignition-distributor rotor: 0,6...1,4 k Ω
* Distributor cap : 0,6...1,4 k Ω
* Spark-plug connector : 4,0...6,0 k Ω



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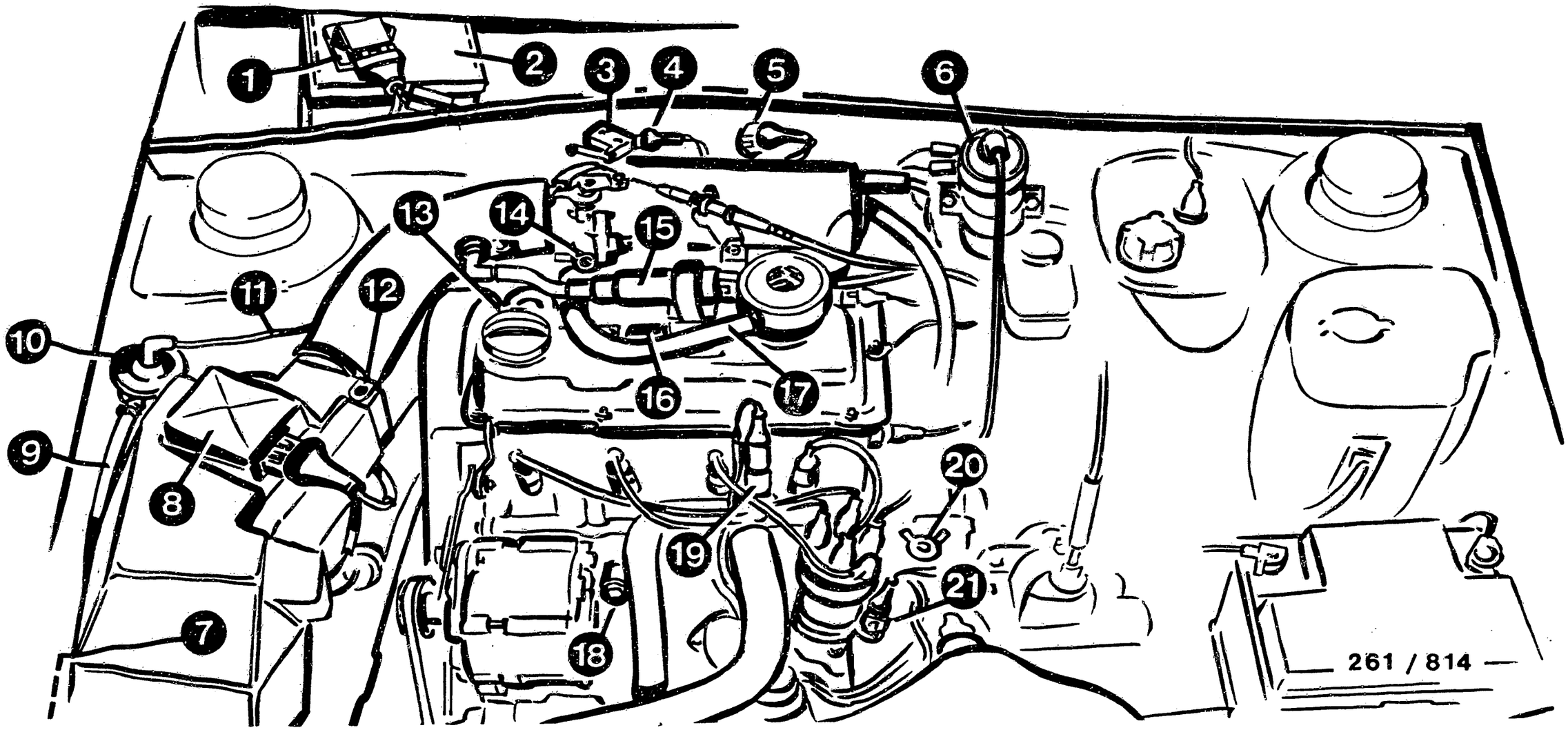
B1= Knock sensor
B2= Temperature sensor (engine)
B3= Air-flow sensor
B4= Magnetic pulse generator (Hall gen.)
B5= Heated lambda sensor (Cat)
B6= Thermo-switch for radiator fan (connection 2: 95°C)
B7= Fuel pressure switch (1.2 bar)
E1= High-tension distributor

F1= Pump fuse (S18/20A)
F2= Fuse for radiator fan (S19/30A)
F3= Fuse for fuel-pump run-on (S15/10A)
K1= Pump relay
K2= Main relay
M1= Starting motor
P1= Fuel gauge
S1= Idle switch
S2= Full-load switch

T1= Ignition coil
X1= Digifant control-unit plug
X2= Ignition-trigger-box plug
X3= Control unit for fuel-pump run-on
X4= Control unit for radiator-fan run-on
Y1= Solenoid-operated injection valves
Y2= Idle actuator
Y3= In-tank electric fuel pump with fuel-gauge sensor

DIGIFANT ELECTRICAL TERMINAL DIAGRAM



1= Ignition trigger box
2= Digifant control unit
3= Full-load switch
4= Plug for full-load/ idle switch
5= Lambda-sensor plug connection
6= Ignition coil
7= Active-carbon container for tank ventilation (Cat.)
8= Air-flow sensor
9= Suction hose to active-carbon container (Cat.)
10= Tank ventilation valve (Cat.) (other install. pos. also possible)
11= Vacuum connection
12= CO adjusting screw
13= Pressure regulator (installation position only indicated in Fig.)
14= Idle-speed adjusting screw
15= Idle actuator
16= Injection valves
17= Hose for crankcase breather
18= Knock sensor
19= Temperature sensor (engine)
20= TDC mark
21= Plug for magnetic pulse generator

INSTALLATION POSITION OF COMPONENTS

INSTALLATION POSITION OF COMPONENTS (continued)

The installation locations always refer to the direction of travel.

* Main/pump relay and pump fuse:
  In fuse box beneath instrument panel on left.
  Main relay in relay plate at relay position no. 3.
  Pump relay in relay plate at relay position no. 12.
  Pump fuse no. 18.

* Control units for fuel-pump and radiator-fan run-on:
  Above relay plate.

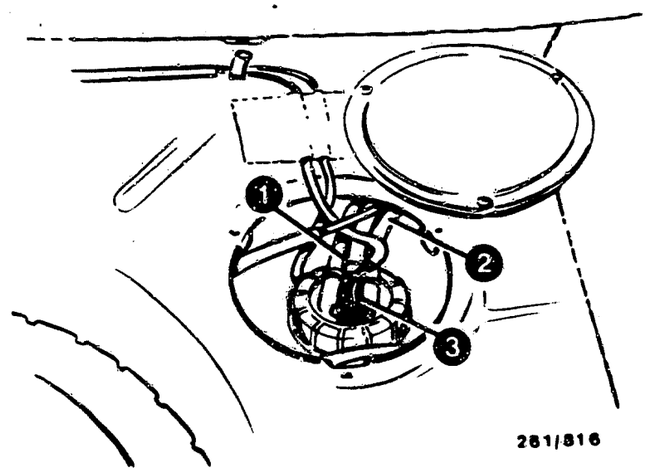
* Fuel pressure switch for fuel-pump run-on:
  In vicinity of solenoid-operated injection valves (2-pole connector).

* Thermo-switch for radiator-fan run-on:
  At cylinder head, in vicinity of intake manifold (1-pole).

* Fuel filter:
  Beneath vehicle, in vicinity of fuel tank.

* In-tank electric fuel pump:
  In fuel tank (top picture).
  Access via trunk.

* Temperature sensor (intake air):
  Integrated into air-flow sensor.



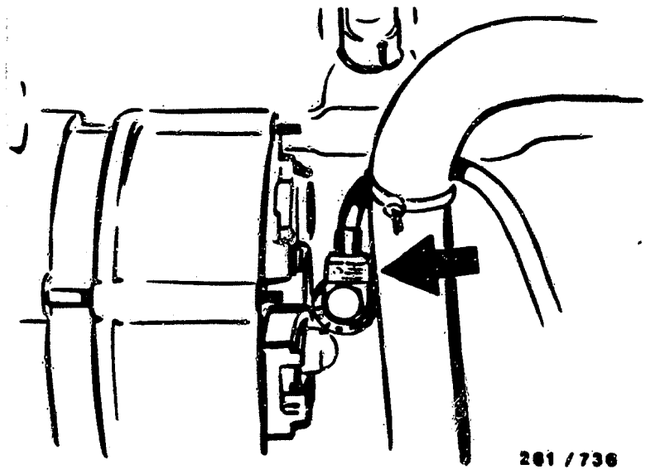
Installation position of in-tank electric fuel pump
1 = Fuel supply line
2 = Fuel return line
3 = Connector for pump and fuel gauge

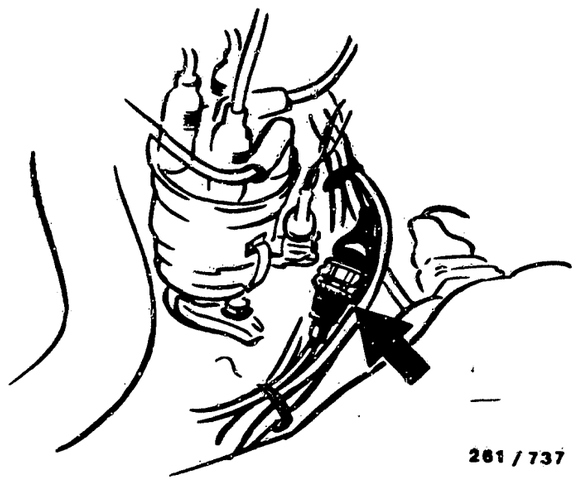
INSTALLATION POSITION OF COMPONENTS (Continued)

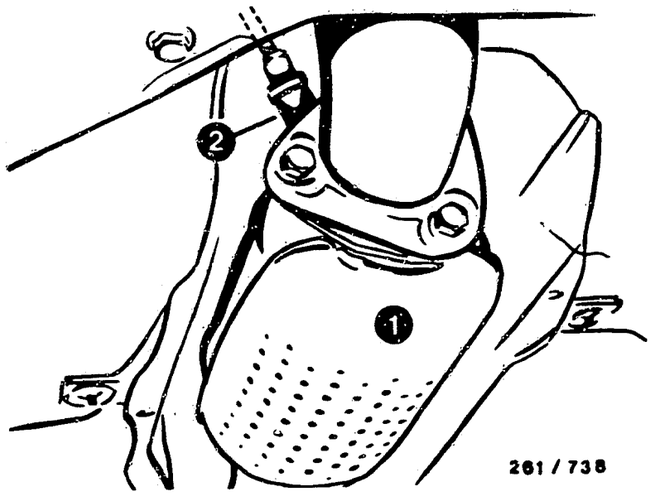
Knock sensor:
On the engine block at the front (upper illustration, arrow).

Plug-in connection to knock sensor:
Near to the ignition distributor (center illustration, arrow).

Lambda sensor:
In the catalytic converter.
See lower illustration ...Pos.1 = Catalytic converter.
Pos.2 = Lambda sensor.


261 / 736


261 / 737



261 / 738

Trouble-shooting instructions : MB-5042

BOSCH system : KE Jetronic 3.1

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

TABLE OF CONTENTS

SPECIAL FEATURES

* These instructions contain the trouble-shooting instructions, valid at the time of publication, for the following model:

MERCEDES-BENZ
190 E 2.6 2.6 1/6-cyl. 08.87->
260 E, SE 2,6 1/6-cyl. 08.87->

* Trouble-shooting with these instructions may only be performed if the data given in the "Summary-Service Information for Vehicles" (KFZ-0..) coincide with those of the type of vehicle and BOSCH number of the built-in KE-Jetronic control unit.

  Multifunctional fuel-induction system with one map for operation with lambda closed-loop control (CAT) and one for operation without lambda closed-loop control (ECE).
  Activation of maps by way of correspondingly labelled trimming plugs. Only the ignition trimming plug has to be re-connected for adjustment to "regular unleaded" and "premium unleaded" fuel.

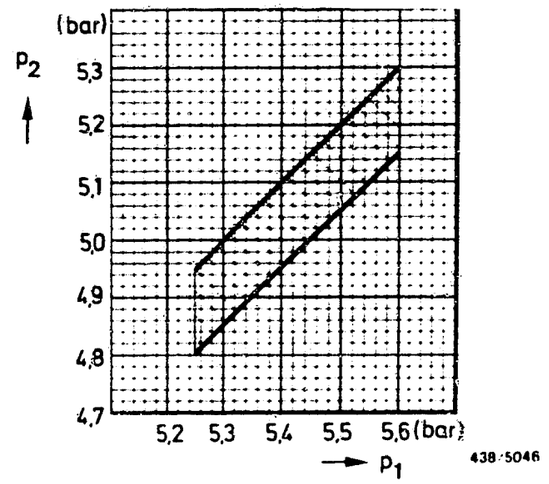
* Electronic idle-speed regulation.

* Active-carbon filter and regeneration valve.

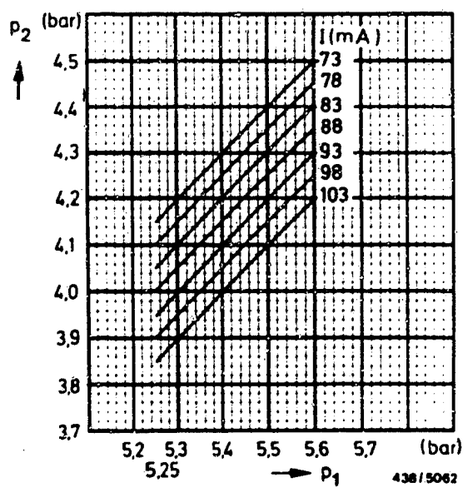
Important:
If reference is made to a basic microcard, it is important to remember that the test specifications are always to be taken from the vehicle-specific brief instructions.
Pay attention to the safety and precautionary measures outlined in the basic instructions, so as to preclude personal injury and so as to prevent engine, trigger-box, control-unit or ignition-system damage.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1300 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ^{3} /min) 6,0 40,0 100,0 140 cm ^{3} /min	Max. permis. delivery: (cm ^{3} /min) 6,6 42,5 109,0



p_1 = Primary pressure
p_2 = Lower-chamber pressure



B03 — ⟹

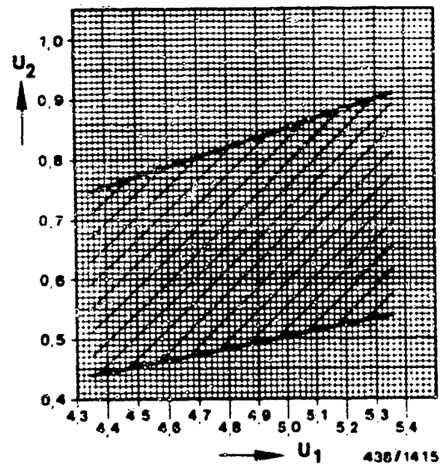
B04 — ⟺

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/requirements for testing	Test specification
7	KE-throttle flow-through quantity:	130...150 cm^3 /min
8	Air-temperature sensor (NTC I): Air temperature +15...+30°C:	 1,3...3,6 k Ω
9	Engine-temperature sensor (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 [illegible]...3,6 k Ω [illegible]...390 Ω
10	Idle-mixture-adjusting screw - basic adjustment: Fuel-distributor support - needle bearing:	 20,9...21,6 mm
11	Idle-speed adjustment: Idle-speed regulation: Adjustment of idle air quantity not possible. Engine must be at operating temperature for testing. Idle speed: Shift to driving position, engine speed: <u>ECE only</u>: CO concentration in exhaust: <u>CAT only</u>: Test lambda closed-loop control: Measurement with lambda closed-loop tester (e.g. KDJE-P 600) and adapter cable (e.g. KDJE-P 600/52) at diagnostic socket (pin 3). Alternative: current measurement with universal test adapter. Render fuel evaporation control system inoperative. Determine the on-off ratio (mean value) at n = 2500 min^{-1} . Deviation of the on-off ratio (mean value) in idle with respect to n = 2500 min^{-1} : Adjustment at idle-mixture-adjusting screw. After correction, repeat measurement.	 650...750 min^{-1} 550...650 min^{-1} 0,5...1,5 vol. %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the KE-Jetronic, including the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/ disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

The "Test specifications" column contains the test specifications for both the version without lambda closed-loop control (ECE, left-hand test-specifications column) and for the version with lambda closed-loop control (CAT, right-hand test-specifications column). Before starting testing, determine which version is being tested. If only one test specification is given, this applies to both versions.

Attention: When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	| V	4	–	Int. resistance(R_i) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	| V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	| V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable
5	| V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0... 10 Ω > 1000 Ω
6	| V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0... 10 Ω
7	| V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0... 10 Ω infinite Ω
8	| V	12	–	Ground, control unit	20– 2		0... 10 Ω
9	| V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0... 10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications ECE	CAT
10	⏐ V	14	–	Trimming plug, mixture characteristic map	22– 2	Disconnect control-unit plug. Disconnect cable connector from air-flow sensor potentiometer and connect socket 1 of the plug (in upper installation position) to engine ground.		
						Trimming-plug position 1:	50... 60 Ω	900... 1050 Ω
						2:	100...120 Ω	1200... 1350 Ω
						3:	150...190 Ω	1500... 1750 Ω
						4:	230...270 Ω	2000... 2400 Ω
						5:	330...370 Ω	3000... 3600 Ω
						6:	430...470 Ω	5000... 5600 Ω
						7:	570...620 Ω	11000...12000 Ω
11	⏐ V	15	–	Transmission switch (aut. transm. only)	16– 2	Connect air-flow sensor potentiometer.		
						Selection-lever position P,N:	0...10 Ω	
						Driving position selected:	infinity Ω	
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined	
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V	
14	7	–	–	Idle actuator, supply and continuity	3– 2	Switch on ignition:	8...15 V	
15	8	–	–	Speed signal	6– 2	Drive vehicle on vehicle-performance tester or road:	Voltage undefined	
16	9	–	–	Air-conditioner cut-in signal	19– 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature	8...15 V	
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V	

B13 — ⟺ B14 — ⟺

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specificatons ECE	CAT
18	11	–	–	Signal, air-flow sensor potentiometer	17– 2	Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous voltage rise up to max.:	0 V 5,35 V	
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V	
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage indefined Voltage change	
21	–	–	–	Peak coil current	12–12	Switch on ignition:	->FD —— : —— mA FD 746->: 9...11 mA	->FD —— : —— mA FD 746->: 18...22 mA
22	–	–	1	Warm-up enrichment +20°C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	->FD —— : —— mA FD ——>: —— mA	->FD —— : —— mA FD ——>: —— mA
23	–	24	2	Actuator current Engine at norm. op. temp.	12–12	Eng. at norm. op. temp., idle Current valve with btn 2 pressed: With CAT, oscillating, mean value:	->FD —— : —— mA FD 746->: -4...+7 mA	->FD —— : —— mA FD 746->: -1...+1 mA
24	–	21	1	Starting enrichment	12–12	So that eng. fails to start: Disconnect speed relay for elec. fuel pump. Short circuit ign. coil term.4 to grnd via resist. of at least 2k Ω (E.g. with sleeve-type suppressor and spark gap) While btn 1 pressed, actuate starting motor. Current rise (max. 1 s.) to:	->FD —— : —— mA FD 746->: 50...80 mA	->FD —— : —— mA FD 746->: 50...80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

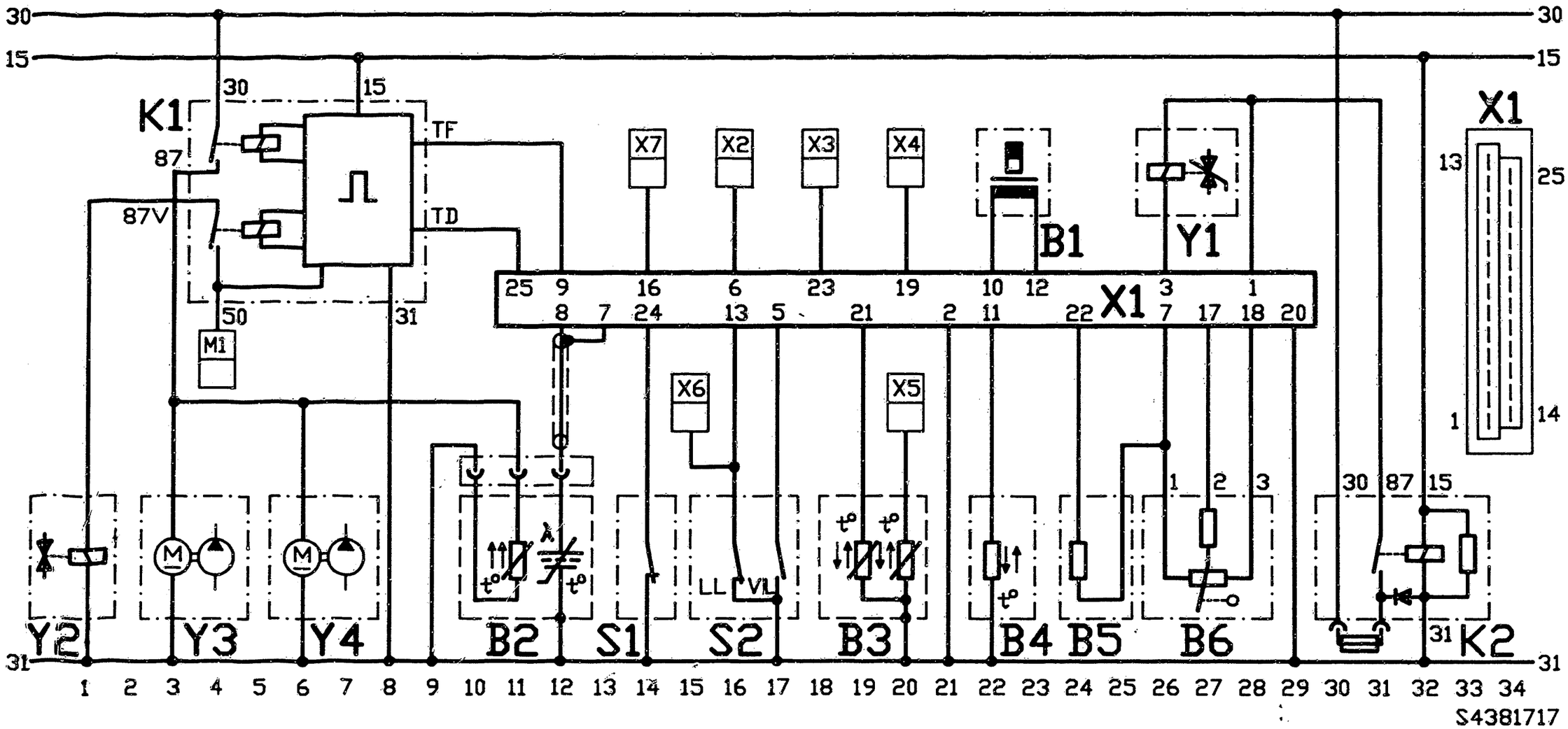
No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while operating btn. 1. Current value: Current constant for several seconds, then slow decrease to control level.	->FD —— : —— mA FD 746->: 20...30 mA	->FD —— : —— mA FD 746->: 20...30 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at operating temp., idling. While pressing btn. 1, sharply accelerate engine. Current increase (approx. 1s) to: Note: The level of current depends on the intensity of acceleration (travel/time of sensor-plate movement).	->FD —— : —— mA FD 746->: 30...70 mA	->FD —— : —— mA FD 746->: 30...70 mA
27	–	–	–	Overrun cut-off	12-12	Change connections on ammeter (swap pos. and negative). Run vehicle on chassis dynamometer or road. Increase eng. speed n briefly to at least approx.: Current reading during falling engine-speed phase: (throttle-valve switch idle closed)	->FD —— : —— min^{-1} FD 746->: 2000 min^{-1} -40...-80 mA	->FD —— : —— min^{-1} FD 746->: 2000 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
28	–	21	–	Full-load enrichment	12-12	Engine at operating temp., idling. Current: Briefly depress accelerator pedal all the way (throttle-valve switch must switch full load). During engine-speed increase, current increase by: Important: Keep this step very brief, to prevent the engine speed from rising too much and damaging the engine.	->FD —— : —— mA FD 746->: -4...+7 mA ->FD —— : —— mA FD 746->: 4...10 mA	->FD —— : —— mA FD 746->: -1...+1 mA ->FD —— : —— mA FD 746->: 4...10 mA
29	–	21	–	Lambda closed-loop control, open-loop operation	12-12	Remove regeneration line to throttle-valve assembly at regeneration valve and seal off. Engine at operating temp. at idle. Current:	——	-1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop operation	12-12	Engine at operating temp. at idle. Closed-loop operation can be recognized by the oscillating current reading. Mean value: If mean value outside tolerance, set (using idle-mixture-adjusting screw) to:	—— ——	-1...+1 mA approx. 0 mA
31	–	22	–	Lambda closed-loop control rich stop	12-12	Engine at operating temp. at idle. Current rise to:	——	12...16 mA
32	–	23	–	Lambda closed-loop control lean stop	12-12	Engine at operating temp. at idle. Current drop to:	——	-8...-12 mA

FD = Date of manufacture

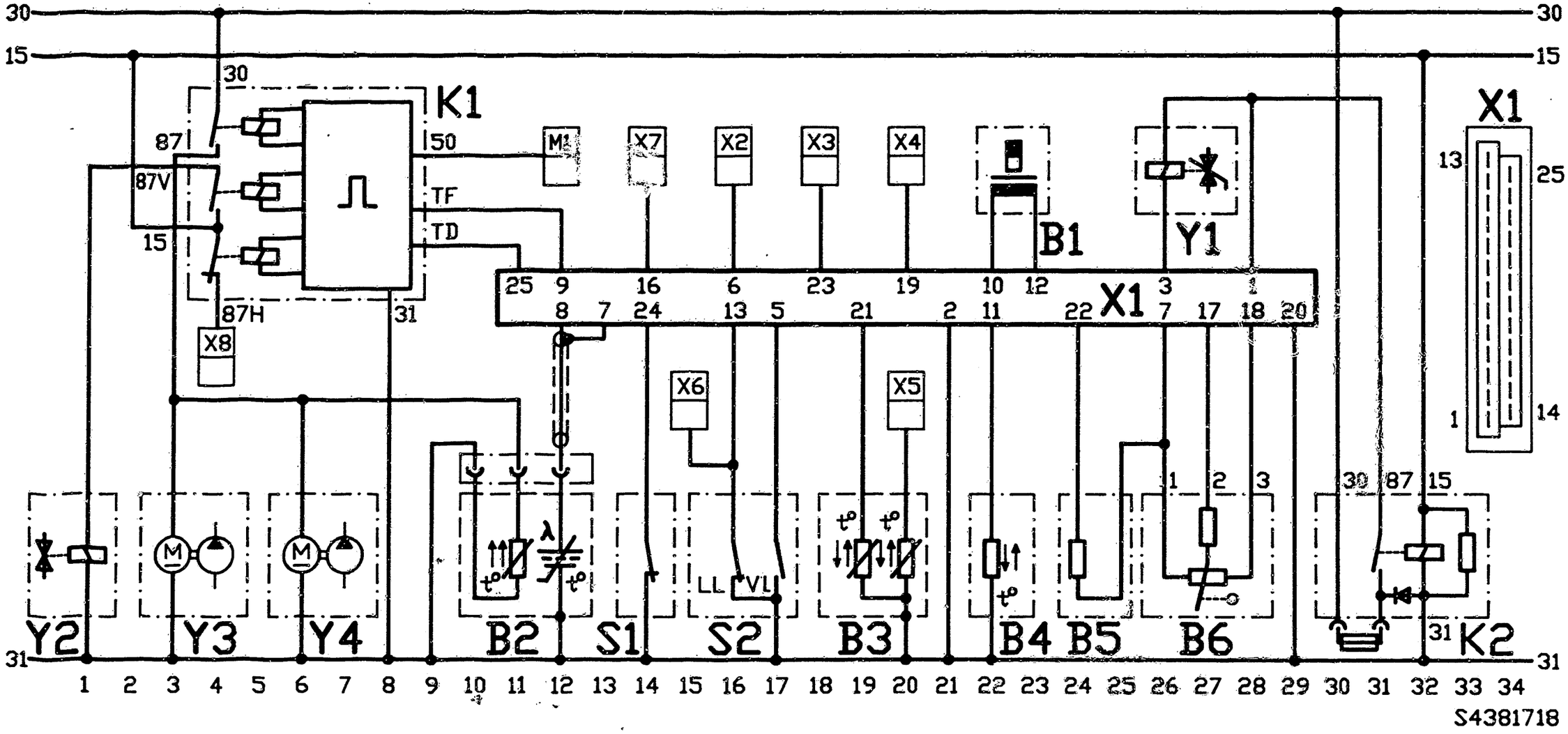


B1 = Pressure actuator
B2 = Lambda sensor
B3 = Temperature sensor (engine)
B4 = Temperature sensor (intake air)
B5 = Trimming plug, map adjustment
B6 = Air-flow-sensor potentiometer
K1 = Electric-fuel-pump relay
K2 = Over-voltage protection relay
M1 = Connection, starting motor, terminal 50
S1 = Microswitch - overrun cutoff
S2 = Throttle-valve switch (full load, idle)

X1 = Plug, KE-control unit
X2 = Speed signal
X3 = Connection, diagnosis socket, pin 3
X4 = to air conditioner
X5 = to ignition trigger box, terminal 1
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch (ground connection with type 201)
Y1 = Idle actuator
Y2 = Start valve
Y3 = Electric fuel pump 1
Y4 = Electric fuel pump 2 (types 124 and 201 only)

ELECTRICAL TERMINAL DIAGRAM (manual transmission)

B21 ⟹
B22 ⟺



B1 = Pressure actuator
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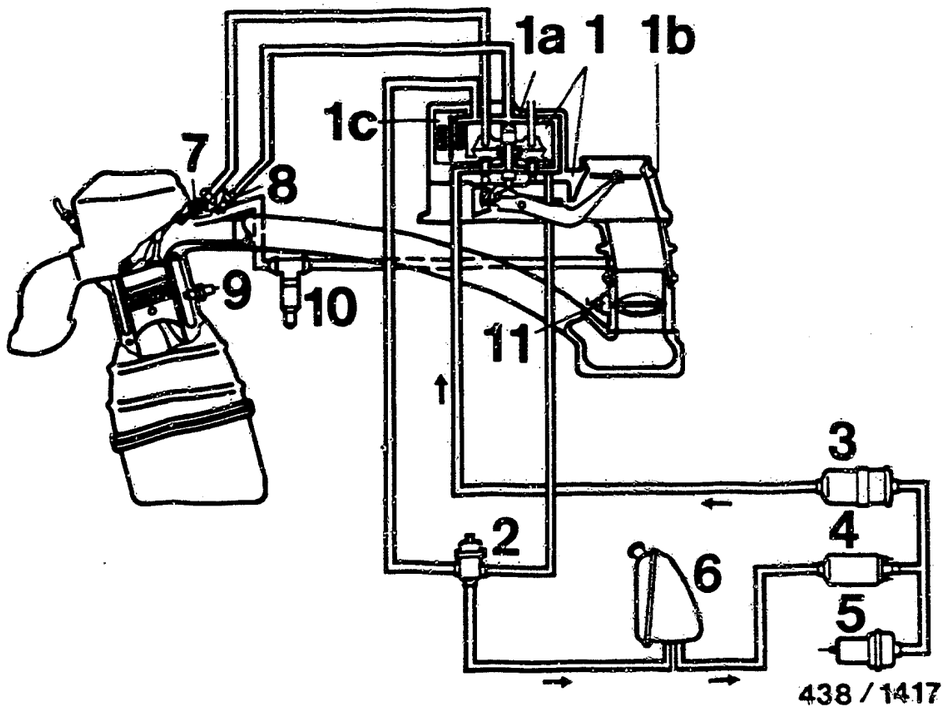
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch
X8 = to kickdown switch
Y1 = Idle actuator
Y2 = Start valve
Y3 = Electric fuel pump 1
Y4 = Electric fuel pump 2 (types 124 and 201 only)

ELECTRICAL TERMINAL DIAGRAM (automatic transmission)

B23 — <=>

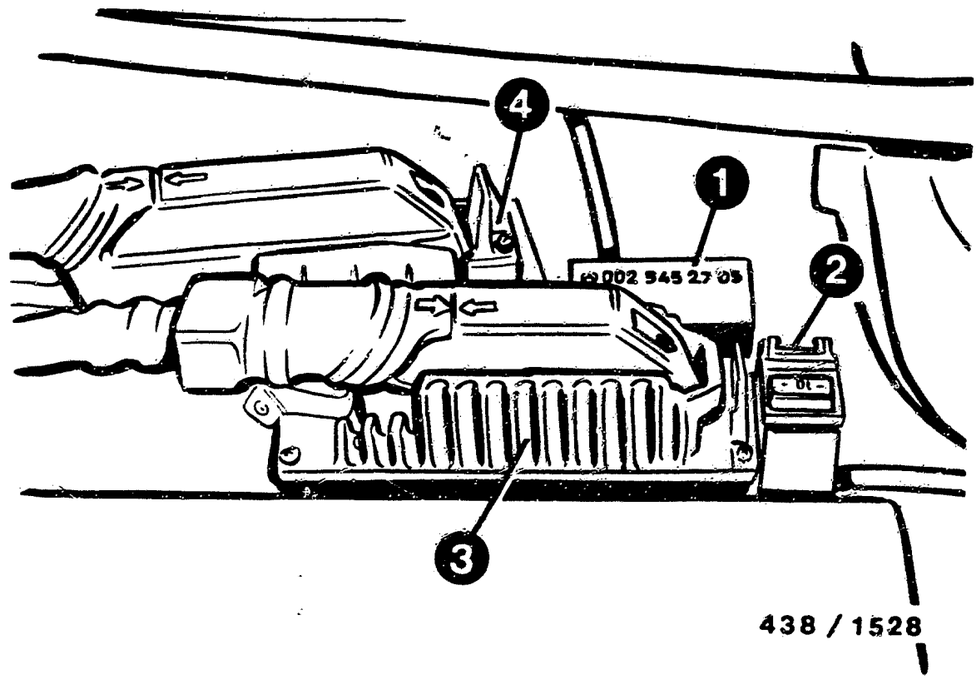
B24 — <=



438 / 1417

1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



438 / 1528

1 = Electronic relay for electric-fuel-pump and cold-start valve actuation

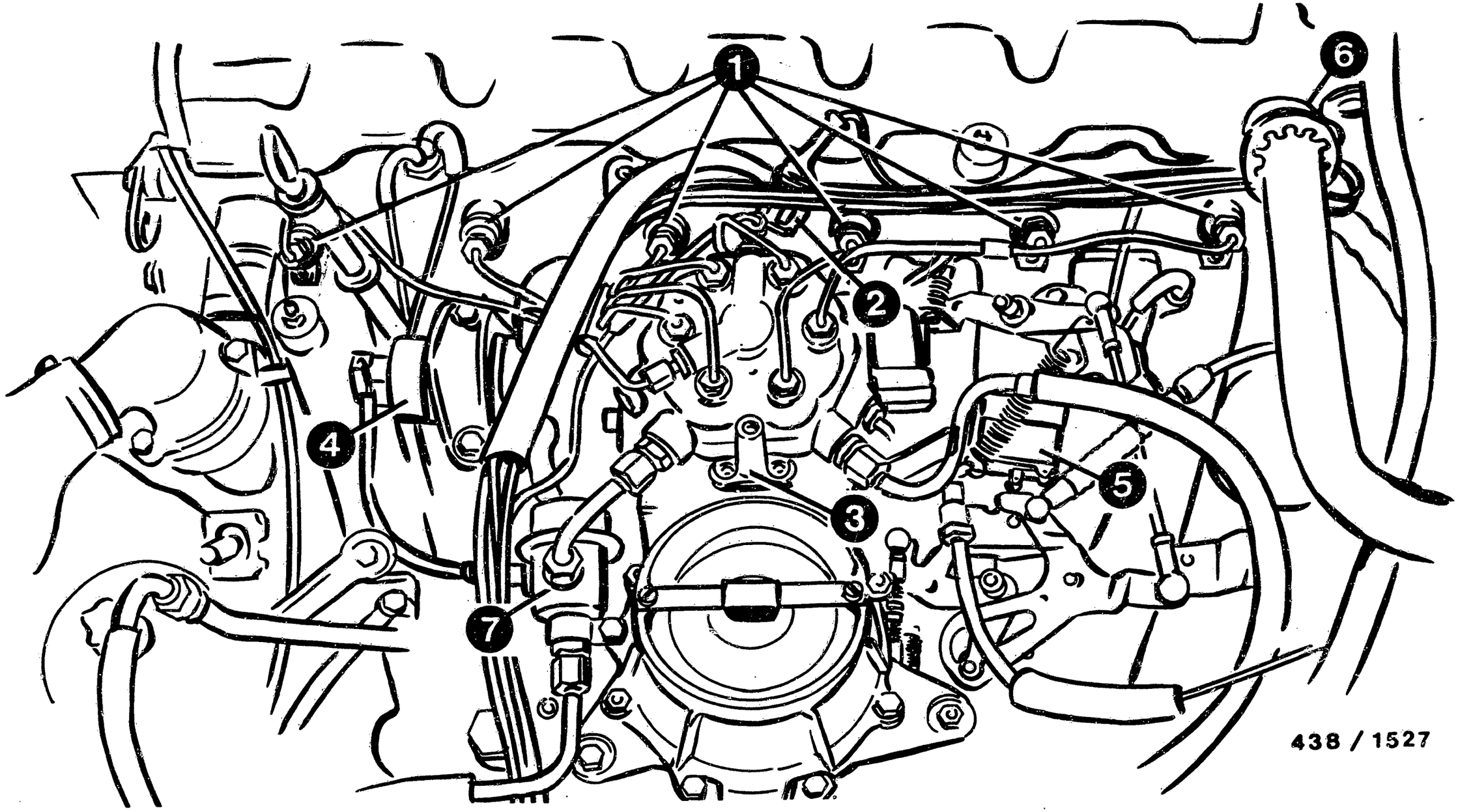
2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

In Type 126, the electric fuel pump relay and the over-voltage protection relay are positioned in the engine compartment on the left.
The KE-Jetronic control unit and the mixture map trimming plug are installed in the footwell on the right behind the side panel in the Type 126.

INSTALLATION POSITION OF COMPONENTS



1 = Fuel-injection valves
2 = Start valve
3 = Mixture-control unit
4 = Idle actuator
5 = Throttle-valve switch, idle (microswitch on accelerator linkage)
6 = Engine-temperature sensor (concealed)
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

Trouble-shooting instructions : MB-5043

BOSCH system : KE Jetronic 3.1

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

TABLE OF CONTENTS

SPECIAL FEATURES

* These instructions contain trouble-shooting instructions, valid at the time of publication, for the following model:

MERCEDES-BENZ
190 E 2.6 2,6 l/6-cyl. US/J/AUS 08.87->
260 E, SE 2,6 l/6-cyl. US/J/AUS 08.87->

* Trouble-shooting with these instructions can only be performed if the data given in the "Summary - Service Information for Vehicles" (KFZ-0..) coincide with those of the type of vehicle and the BOSCH number of the built-in KE-Jetronic control unit.

* Electronically controlled idle-speed regulation with single-winding rotary actuator, without bypass adjusting screw.

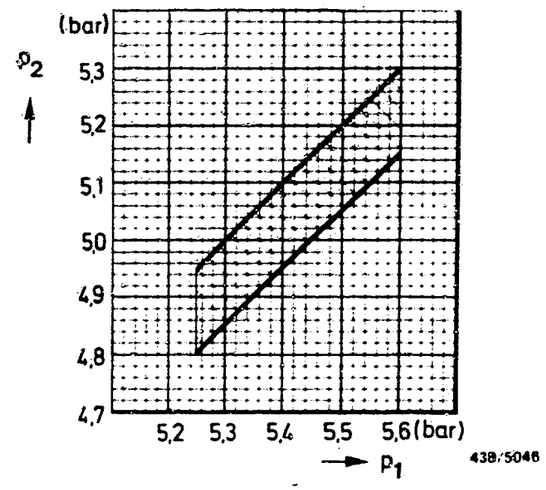
* Active-carbon filter and regeneration valve for returning fuel vapours to intake manifold. (Fuel evaporation system)

* Diagnosis lamp "CHECK ENGINE" lights up as a functional check when ignition is switched on. When engine is running, this lamp indicates failure of the lambda sensor.

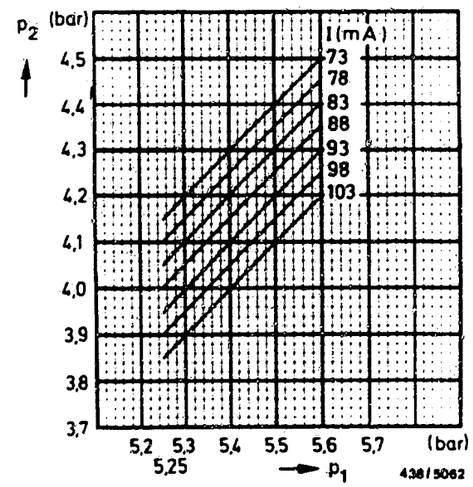
Important:
If reference is made to a basic microcard, the test specifications are always to be taken from the vehicle-specific brief instructions.
Pay attention to safety and precautionary measures given in basic instructions, so as to preclude personal injury and so as to prevent engine, trigger-box, control-unit or ignition-system damage.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1300 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ^{3} /min) 6,0 40,0 100,0 140 cm ^{3} /min	Max. permis. delivery: (cm ^{3} /min) 6,6 42,5 109,0



p_1 = Primary pressure
p_2 = Lower-chamber pressure



C03 — ⟹

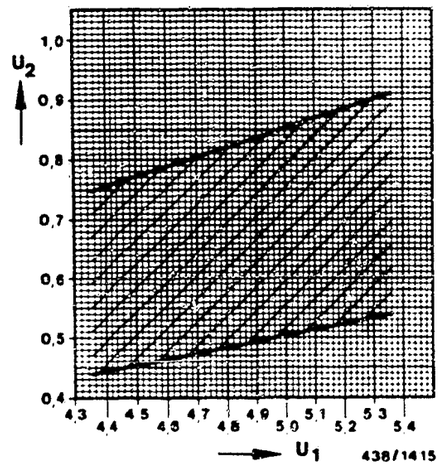
C04 — ⟺

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm^3 /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	 – k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting. Fuel-distributor seat – needle bearing:	 20,9...21,6 mm
11	Idle adjustment: Low-idle-speed control: adjustment of idle-air quantity not possible. For testing, engine at norm. op. temp. Idle speed: Engage driving position, speed: Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adpater lead (e.g. KDJE-P 600/52) at diagnosis socket outlet (pin 3). Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. Determine on/off ratio (mean value) at n = 2500 min^{-1} . Deviation of on/off ratio (mean value) at idle compared to n = 2500 min^{-1} : Adjustment at idle-mixture-adjusting screw. After adjustment, repeat measurement.	 650...750 min^{-1} 550...650 min^{-1} –10...+10 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for experienced Jetronic specialists to rapidly check the electrical/electronic peripheral and control-unit functions of the KE-Jetronic including the lambda closed-loop control.

Important information regarding the following rapid diagnosis chart:

The "Test conditions" column indicates the test steps for which the control-unit plug must be connected/detached. Whenever the plug is connected or detached, care is to be taken to ensure that the system is deenergized, i.e. the ignition must be switched off and the electrical safety circuit must not be jumpered.

The "Test connections" column provides information on the connected leads in each measuring path referenced to the assignment in the control-unit plug. Any trouble-shooting measures which may be required relate to these leads.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	V	4	—	Internal resistance (R_i) pressure actuator	12–10	Disconnect control-unit plug.	20...30 Ω
2	V	5	—	Resistance, temperature sensor (engine)	21– 2	Engine temperature +15...+30°C: approx. +80°C:	1,3...3,6 k Ω 250...390 Ω
3				Resistance, temperature sensor (intake air)		Air temperature in area of NTC I = +15...+30°C:	Test step not applicable
4	V	6	—	Signal, altitude sensor	11– 2	Connect control unit. Switch on ignition. Voltmeter connection to blue Ω -sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	 3,2...4,5 V 2,8...4,0 V 2,4...3,5 V 2,0...3,0 V 1,6...2,5 V 0,8...1,6 V
5	V	9	—	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	 0...10 Ω > 1000 Ω
6	V	10	—	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	V	11	—	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	V	12	—	Ground, control unit	20– 2		0...10 Ω
9	V	13	—	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
10	⎍ V	14	–	Trimming plug mixture map	22– 2	Disconnect control-unit plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) to engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 – Ω – Ω – Ω – Ω – Ω – Ω – Ω
11	⎍ V	15	–	Transmission switch (automatic transmission only)	16– 2	Connect air-flow sensor potentiometer. Selection lever position P,N: Driving position selected:	 0...10 Ω infinite Ω
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:	8...15 V
15	8	–	–	Speed signal	6– 2	Drive vehicle on chassis dynamometer or road:	Voltage undefined
16	9	–	–	Air-conditioner cut-in signal	19– 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature	 8...15 V
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
18	11	–	–	Signal, air-flow sensor potentiometer	17– 2	Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous rise up to max.:	0 V 5,35 V
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage undefined Voltage change
21	–	–	–	Peak coil current	12–12	Switch on ignition:	->FD —— : —— mA FD 746->: 18...22 mA
22	–	21	1	Warm-up enrichment + 20° C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	->FD —— : —— mA FD ——>: —— mA
23	–	24	2	Actuator current engine at normal operating temperature	12–12	Engine at normal operating temperature, idle. Current value with btn 2 pressed; reading oscillating, mean value:	->FD —— : —— mA FD 746->: –1...+1 mA
24	–	21	2	Starting enrichment	12–12	So that engine fails to start: Disconnect speed relay for electric fuel pump. Short circuit ignition coil term.4 to ground via resistance of at least 2k Ω . (e.g. with sleeve-type suppressor and spark gap) While btn 2 pressed, actuate starting motor. Current rise (max. 1 sec.) to:	->FD —— : —— mA FD 746->: 40...60 mA

FD = Date of manufacture

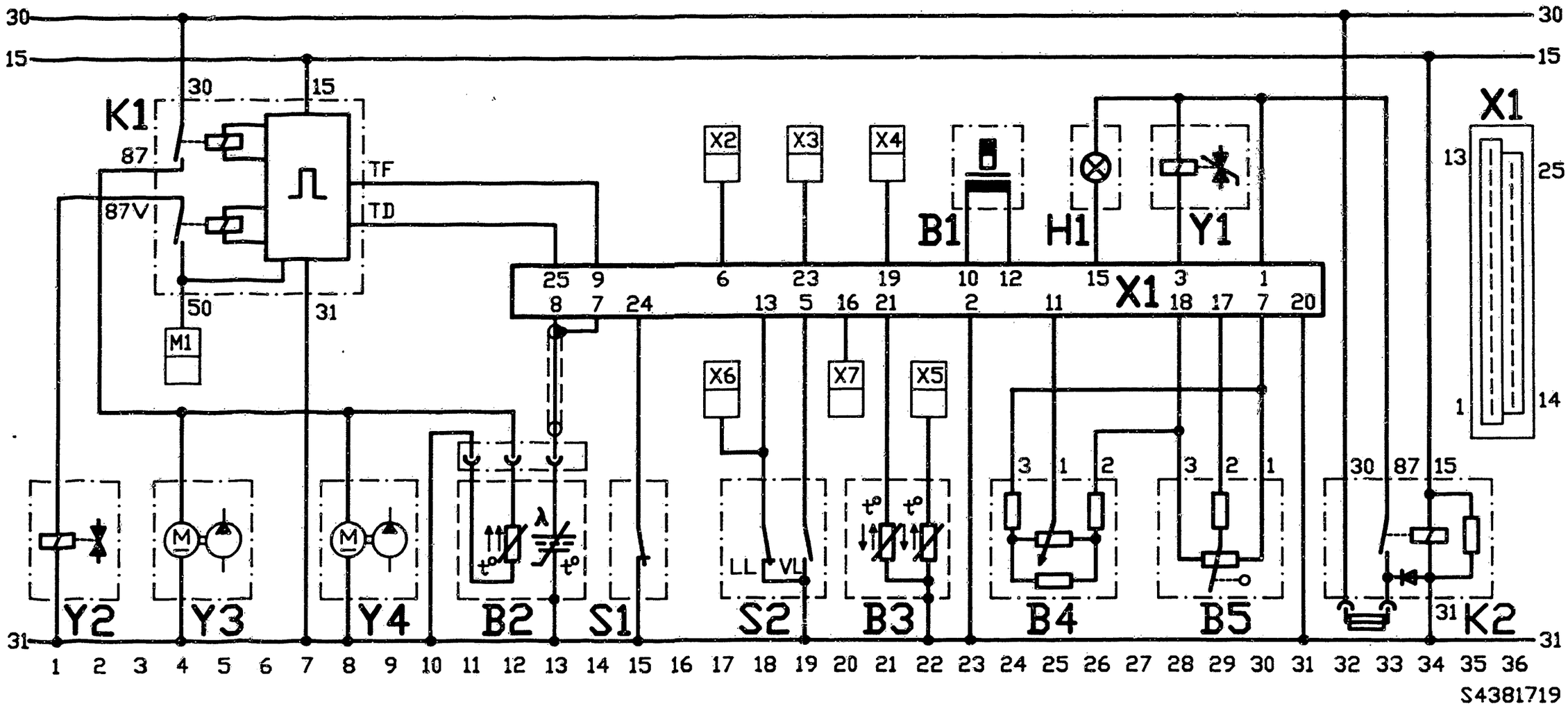
No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while actuating btn 1. Current value: Current value constant for a few seconds, then slow speed regulation.	->FD —— : —— mA FD 746->: 22...26 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at normal operating temperature, idle. While actuating btn 1, perform snap acceleration of engine. Thus current rise (approx. 1 sec.) to: Note: Level of current value dependent upon intensity of acceleration (travel/duration of air-flow sensor plate movement).	->FD —— : —— mA FD 746->: 40...70 mA
27	–	–	--	Overrun cut-off	12-12	Re-connect ohmmeter (swap positive and negative). Start engine (normal operating temperature). Drive vehicle on chassis dynamometer or road. Increase speed n briefly to at least approx.: Current reading during falling speed phase: (idle throttle-valve switch closed)	->FD —— : —— min $^{-1}$ FD 746->: 2000 min $^{-1}$ -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specification CAT
28	–	24	–	Full-load enrichment	12-12	Engine at normal operating temperature, idle. Reading oscillating, mean value: Briefly push accelerator pedal to floor (full-load throttle-valve switch must switch). During speed rise, current value rises by: A t t e n t i o n: Do this very briefly, so that speed does not rise too much and engine is not damaged.	 ->FD ——: —— mA FD 746 ->: -1...+1 mA ->FD ——: —— mA FD 746 ->: 5...11 mA
29	–	21	–	Lambda closed-loop control, open-loop control mode	12-12	Disconnect regeneration lead to throttle-valve assembly at generation valve and seal. Engine at norm. op. temp., idle. Current value:	 -1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop control mode	12-12	Engine at norm. op. temp., idle. Closed-loop control mode can be recognized from the oscillating current reading. Mean value: If mean value outside tolerance, set (idle-mixture-adjusting screw) to approx.:	 -1...+1 mA 0 mA
31	–	22	–	Lambda closed-loop control, rich stop	12-12	Engine at norm. op. temp., idle. Current rise to:	 12...16 mA
32	–	23	–	Lambda closed-loop control, lean stop	12-12	Engine at norm. op. temp., idle. Current drop to:	 -8...-12 mA

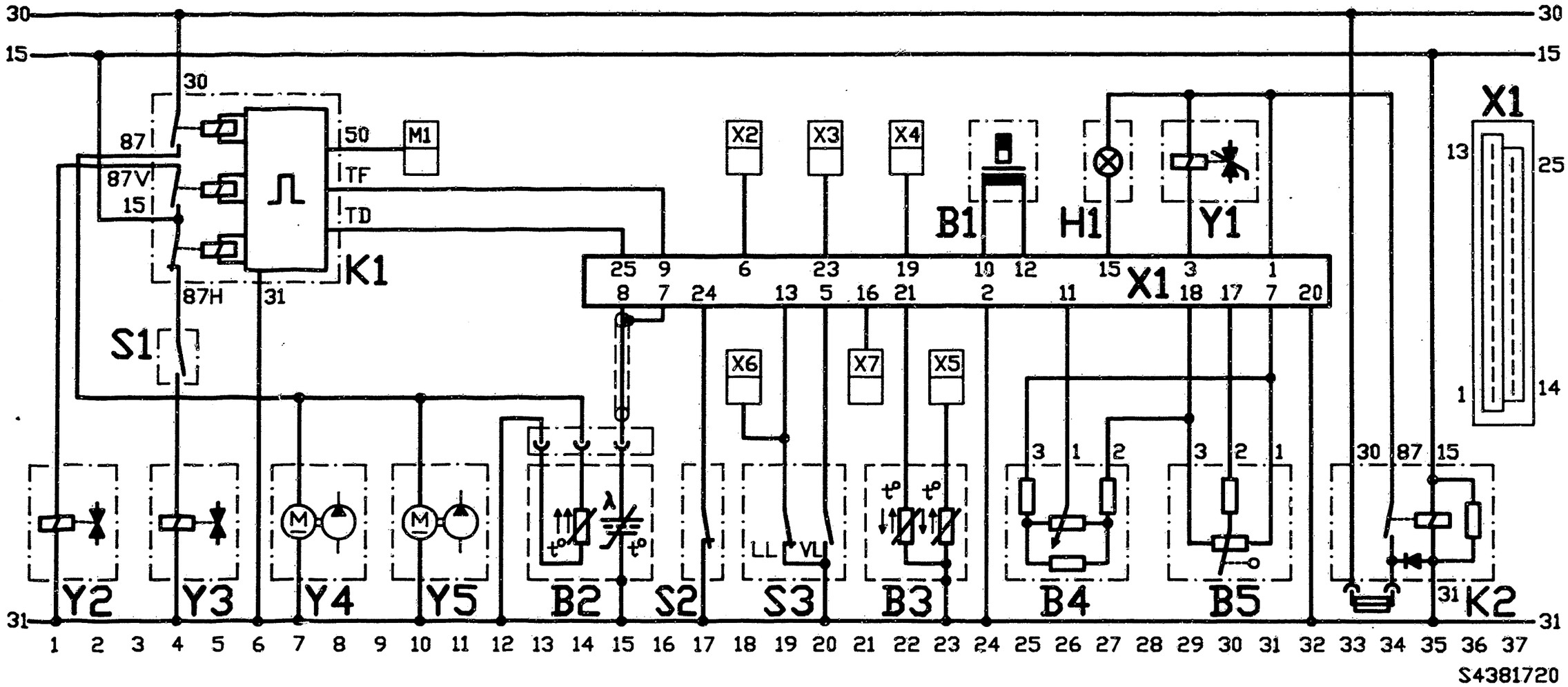
*) FD = Date of manufacture



B1 = Pressure actuator
B2 = Lambda sensor
B3 = Temperature sensor (engine)
B4 = Altitude sensor
B5 = Air-flow-sensor potentiometer
H1 = Diagnosis lamp (CHECK ENGINE)
K1 = Electronic-fuel-pump relay
K2 = Over-voltage protection relay
M1 = Connection, starting motor, terminal 50
S1 = Microswitch - overrun cutoff
S2 = Throttle-valve switch (full load, idle)

X1 = Plug, KE-control unit
X2 = Speed signal
X3 = Connection, diagnosis socket, pin 33
X4 = to air conditioner
X5 = to ignition trigger box, terminal 1
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch (ground connection with type 201)
Y1 = Idle actuator
Y2 = Start valve
Y3 = Electric fuel pump 1
Y4 = Electric fuel pump 2

ELECTRICAL TERMINAL DIAGRAM (manual transmission)



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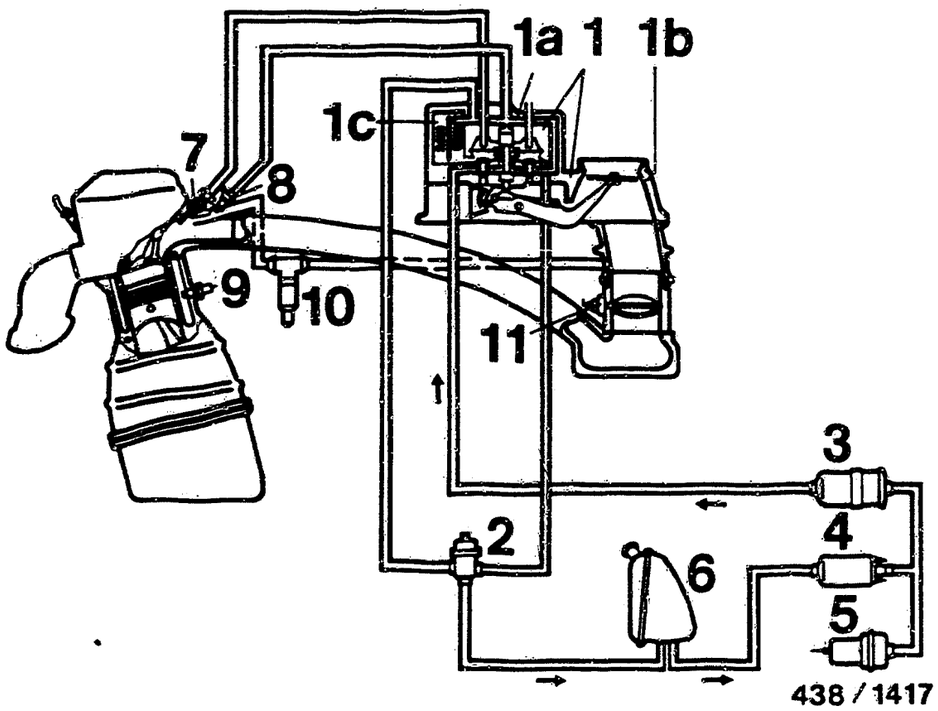
B1 = Pressure actuator
B2 = Lambda sensor
B3 = Temperature sensor (engine)
B4 = Altitude sensor
B5 = Air-flow-sensor potentiometer
H1 = Diagnosis lamp (CHECK ENGINE)
K1 = Electric-fuel-pump relay
K2 = Over-voltage protection relay
M1 = Connection, starting motor, terminal 50
S1 = Kickdown switch
S2 = Microswitch, overrun cutoff
S3 = Throttle-valve switch (full load, idle)

X1 = Plug,KE-control unit
X2 = Speed signal
X3 = Connection, diagnosis socket, pin 3
X4 = to air conditioner
X5 = to ignition trigger box, terminal 1
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch
Y1 = Idle actuator
Y2 = Start valve
Y3 = Change-over valve
Y4 = Electric fuel pump 1
Y5 = Electric fuel pump 2

ELECTRICAL TERMINAL DIAGRAM (automatic transmission)

C23 — <==>

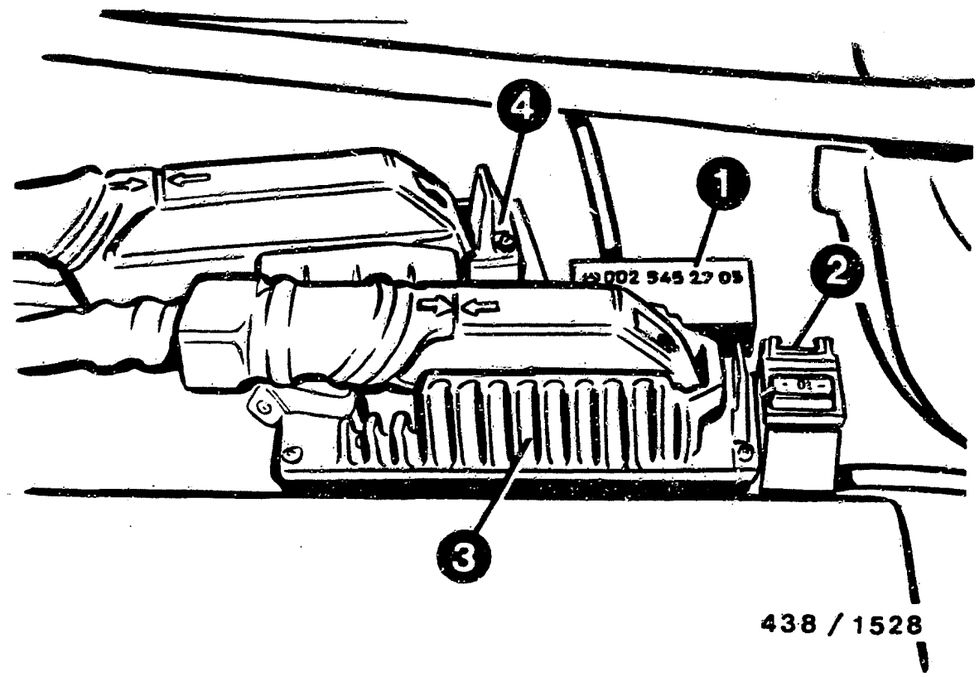
C24 — <==



438/1417

1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



438/1528

1 = Electronic relay for electric-fuel-pump and cold-start valve actuation

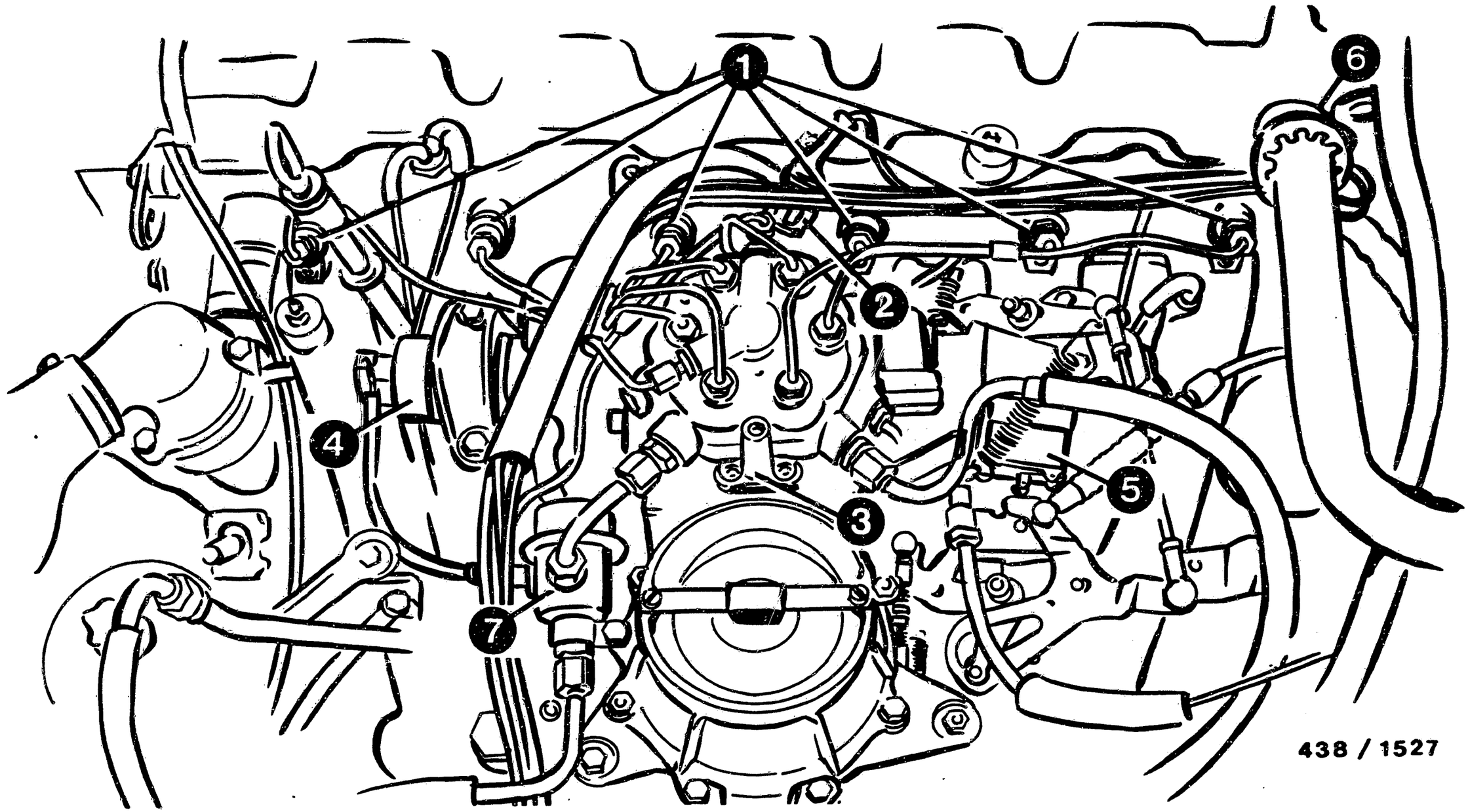
2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

In Type 126, the electric fuel pump relay and the over-voltage protection relay are positioned in the engine compartment on the left.
The KE-Jetronic control unit and the mixture map trimming plug are installed in the footwell on the right behind the side panel in the Type 126.

INSTALLATION POSITION OF COMPONENTS



1 = Fuel-injection valves
2 = Start valve
3 = Mixture-control unit
4 = Idle actuator
5 = Throttle-valve switch, idle (microswitch on accelerator linkage)
6 = Engine-temperature sensor (concealed)
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

Trouble-shooting instructions : MB-5044

BOSCH system : KE Jetronic 3.1

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

TABLE OF CONTENTS

SPECIAL FEATURES

* These instructions contain trouble-shooting instructions, valid at the time of publication, for the following model:

MERCEDES-BENZ
300E/CE/TE/SE/SEL/SL 3,0 1/6-cyl. 08.87->

* Trouble-shooting with these instructions may only be performed if the data in the "Summary - Service Information for Vehicles" (KFZ-0..) coincide with those of the type of vehicle and the BOSCH number of the built-in KE-Jetronic control unit.

* Multifunctional fuel-induction system with one map for operation with lambda closed-loop control (CAT) and one for operation without lambda closed-loop control (ECE). Activation of maps by way of appropriately labelled trimming plugs. Re-connection of the ignition trimming plug is all that is required for adjustment to "regular unleaded" or "premium unleaded" fuel.

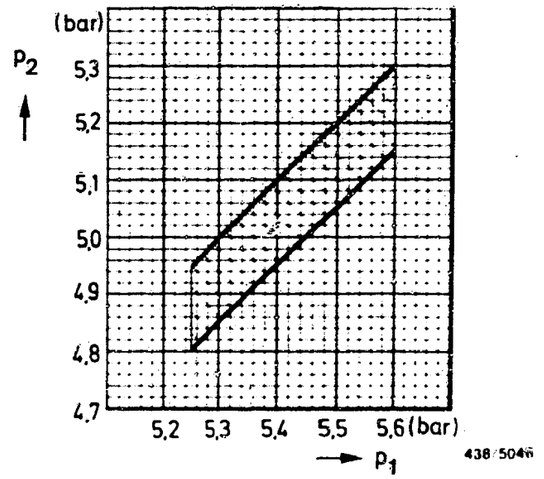
* Electronic idle-speed regulation.

* Active-carbon filter and regeneration valve.

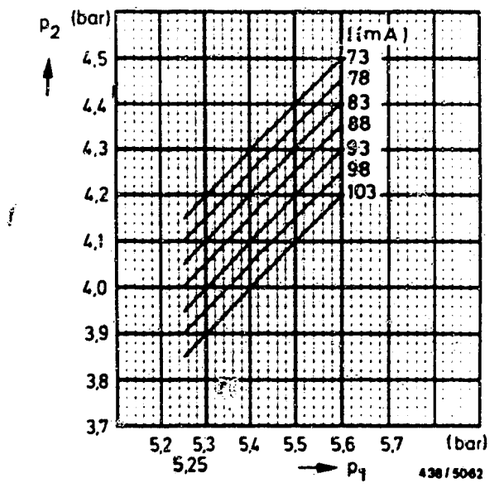
Important:
If reference is made to a basic microcard, it should be remembered that the test specifications are always to be taken from the vehicle-specific brief instructions.
Pay attention to safety and precautionary measures outlined in basic instructions, so as to preclude personal injury and so as to prevent engine, trigger-box, control-unit or ignition-system damage.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1400 cm^3 /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA)	Setting point: (cm^3 /min)	Max. permis. delivery: (cm^3 /min)
	Idle: Part load: Full load:	6,0 40,0 100,0	6,6 42,5 109,0
	Min. delivery at max. air-flow sensor plate defl.:	140 cm^3 /min	



p_1 = Primary pressure
p_2 = Lower-chamber pressure



D03 — ⟹

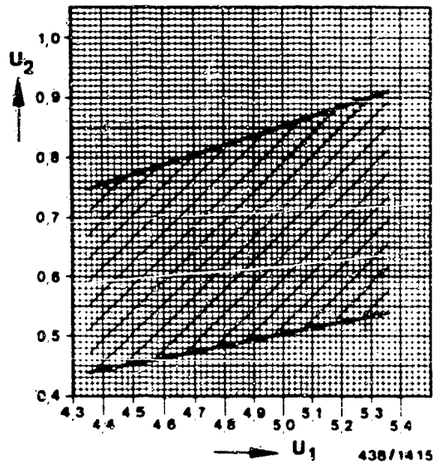
D04 — ⟺

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/requirements for testing	Test specification
7	KE-throttle flow-through quantity:	130...150 cm^3 /min
8	Air-temperature sensor (NTC I): Air temperature +15...+30°C:	1,3...3,6 k Ω
9	Engine-temperature sensor (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw - basic adjustment: Fuel-distributor support - needle bearing:	 20,9...21,6 mm
11	Idle-speed adjustment: Idle-speed regulation: Adjustment of idle air quantity not possible. Engine must be at operating temperature for testing. Idle speed: Shift to driving position, engine speed: ECE only: CO concentration in exhaust: CAT only: Test lambda closed-loop control: Measurement with lambda closed-loop tester (e.g. KDJE-P 600) and adapter cable (e.g. KDJE-P 600/52) at diagnostic socket (pin 3). Alternative: current measurement with universal test adapter. Render fuel evaporation control system inoperative. Determine the on-off ratio (mean value) at n = 2500 min^{-1} . Deviation of the on-off ratio (mean value) in idle with respect to n = 2500 min^{-1} : Adjustment at idle-mixture-adjusting screw. After correction, repeat measurement.	 620...720 min^{-1} 500...600 min^{-1} 0,5...1,5 vol. % -10...+10 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART TO UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND APPROPRIATE MULTITESTER:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electric/electronic peripheral and control-unit functions of the KE-Jetronic, including the lambda closed-loop control.

Important note on the rapid diagnosis chart:

The "Test conditions" column gives information as to in which test steps the control-unit plug must be connected/disconnected. Make absolutely certain that there is no current at the system when connecting or disconnecting, i.e. the ignition must be switched off and the electric safety circuit must not be short circuited.

The "Test connections" column provides information about the leads connected to the respective measuring path, referring to the assignment in the control-unit plug. Possibly necessary trouble-shooting is with regard to these leads.

The "Test specifications" column contains the test specifications for both the version without lambda closed-loop control (ECE, left-hand test-specifications column) and for the version with lambda closed-loop control (CAT, right-hand test-specifications column). Before starting testing, determine which version is being tested. If only one test specification is given, this applies to both versions.

Attention: When carrying out the test, make sure that the trimming plug is in position 1.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	| V	4	–	Int. resistance(R_i) pressure actuator	12–10	Disconnect control-unit lead plug.	20...30 Ω
2	| V	5	–	Resistor NTC II (engine)	21– 2	Engine temperature +15°...+30° C: approx. +80° C:	1,3...3,6k Ω 250...390 Ω
3	| V	6	–	Resistor NTC I (intake air)	11– 2	Air temperature in area of NTC I: +15°...+30° C:	1,3...3,6k Ω
4				Signal, altitude sensor		Connect control unit. Switch on ignition. Voltmeter connection to blue Ω sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	Test step not applicable!
5	| V	9	–	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	0... 10 Ω > 1000 Ω
6	| V	10	–	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0... 10 Ω
7	| V	11	–	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0... 10 Ω infinite Ω
8	| V	12	–	Ground, control unit	20– 2		0... 10 Ω
9	| V	13	–	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0... 10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications ECE	CAT
10	| V	14	–	Trimming plug, mixture characteristic map	22– 2	Disconnect control-unit plug. Disconnect cable connector from air-flow sensor potentiometer and connect socket 1 of the plug (in upper installation position) to engine ground.		
						Trimming-plug position 1:	50... 60 Ω	900... 1050 Ω
						2:	100...120 Ω	1200... 1350 Ω
						3:	150...190 Ω	1500... 1750 Ω
						4:	230...270 Ω	2000... 2400 Ω
						5:	330...370 Ω	3000... 3600 Ω
						6:	430...470 Ω	5000... 5600 Ω
						7:	570...620 Ω	11000...12000 Ω
11	| V	15	–	Transmission switch (aut. transm. only)	16– 2	Connect air-flow sensor potentiometer.		
						Selection-lever position P,N:	0...10 Ω	
						Driving position selected:	infinity Ω	
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined	
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V	
14	7	–	–	Idle actuator, supply and continuity	3– 2	Switch on ignition:	8...15 V	
15	8	–	–	Speed signal	6– 2	Drive vehicle on vehicle-performance tester or road:	Voltage undefined	
16	9	–	–	Air-conditioner cut-in signal	19– 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature	8...15 V	
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V	

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specificatons ECE	CAT
18	11	–	–	Signal, air-flow sensor potentiometer	17– 2	Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous voltage rise up to max.:	0 V 5,35 V	
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V	
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage indefined Voltage change	
21	–	–	–	Peak coil current	12–12	Switch on ignition:	->FD —— : —— mA FD 746->: 9...11 mA	->FD —— : —— mA FD 746->: 18...22 mA
22	–	–	1	Warm-up enrichment +20°C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	->FD —— : —— mA FD ——>: —— mA	->FD —— : —— mA FD ——>: —— mA
23	–	24	2	Actuator current Engine at norm. op. temp.	12–12	Eng. at norm. op. temp., idle Current valve with btn 2 pressed: With CAT, oscillating, mean value:	->FD —— : —— mA FD 746->: -4...+7 mA	->FD —— : —— mA FD 746->: -1...+1 mA
24	–	21	1	Starting enrichment	12–12	So that eng. fails to start: Disconnect speed relay for elec. fuel pump. Short circuit ign. coil term.4 to grnd via resist. of at least 2k Ω (E.g. with sleeve-type suppressor and spark gap) While btn 1 pressed, actuate starting motor. Current rise (max. 1 s.) to:	->FD —— : —— mA FD 746->: 50...80 mA	->FD —— : —— mA FD 746->: 50...80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER EIT 018.01 (CONTINUED)

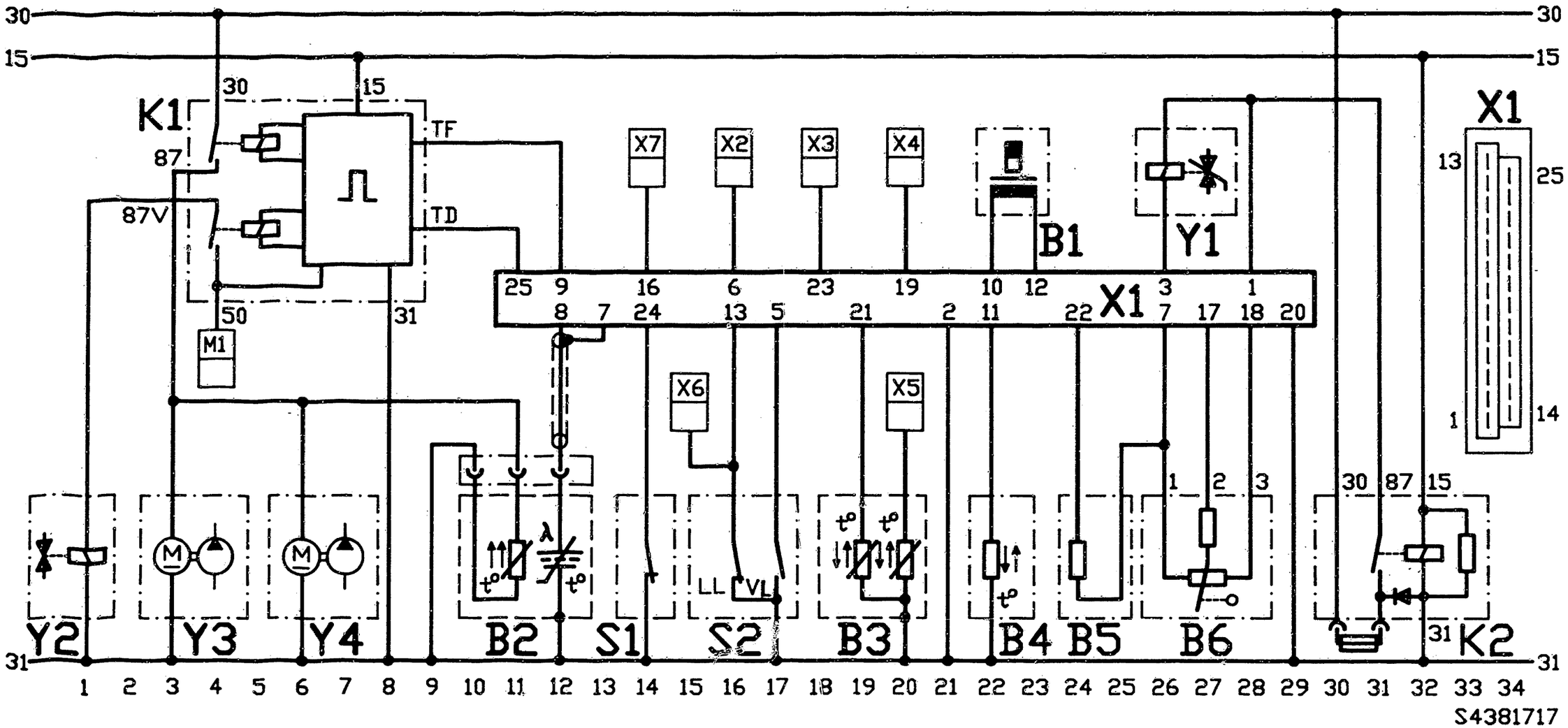
No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
25	–	21	1	Post-start enrichment	12-12	Start engine (at normal operating temperature) while operating btn. 1. Current value: Current constant for several seconds, then slow decrease to control level.	->FD —— : —— mA FD 746->: 17...27 mA	->FD —— : —— mA FD 746->: 19...29 mA
26	–	21	1	Acceleration enrichment	12-12	Engine at operating temp., idling. While pressing btn. 1, sharply accelerate engine. Current increase (approx. 1s) to: Note: The level of current depends on the intensity of acceleration (travel/time of sensor-plate movement).	->FD —— : —— mA FD 746->: 30...70 mA	->FD —— : —— mA FD 746->: 30...70 mA
27	–	–	–	Overrun cut-off	12-12	Change connections on ammeter (swap pos. and negative). Run vehicle on chassis dynamometer or road. Increase eng. speed n briefly to at least approx.: Current reading during falling engine-speed phase: (throttle-valve switch idle closed)	->FD —— : —— min^{-1} FD 746->: 2000 min^{-1} -40...-80 mA	->FD —— : —— min^{-1} FD 746->: 2000 min^{-1} -40...-80 mA

FD = Date of manufacture

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn. V	Ω	Btn.	Subject of testing	Test pins	Test conditions	Test specifications ECE	CAT
28	–	21	–	Full-load enrichment	12-12	Engine at operating temp., idling. Current: Briefly depress accelerator pedal all the way (throttle-valve switch must switch full load). During engine-speed increase, current increase by: Important: Keep this step very brief, to prevent the engine speed from rising too much and damaging the engine.	->FD —— : —— mA FD 746->: -4...+7 mA ->FD —— : —— mA FD 746->: 4...10 mA	->FD —— : —— mA FD 746->: -1...+1 mA ->FD —— : —— mA FD 746->: 4...10 mA
29	–	21	–	Lambda closed-loop control, open-loop operation	12-12	Remove regeneration line to throttle-valve assembly at regeneration valve and seal off. Engine at operating temp. at idle. Current:	——	-1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop operation	12-12	Engine at operating temp. at idle. Closed-loop operation can be recognized by the oscillating current reading. Mean value: If mean value outside tolerance, set (using idle-mixture-adjusting screw) to:	—— ——	-1...+1 mA approx. 0 mA
31	–	22	–	Lambda closed-loop control rich stop	12-12	Engine at operating temp. at idle. Current rise to:	——	12...16 mA
32	–	23	–	Lambda closed-loop control lean stop	12-12	Engine at operating temp. at idle. Current drop to:	——	-8...-12 mA

FD = Date of manufacture

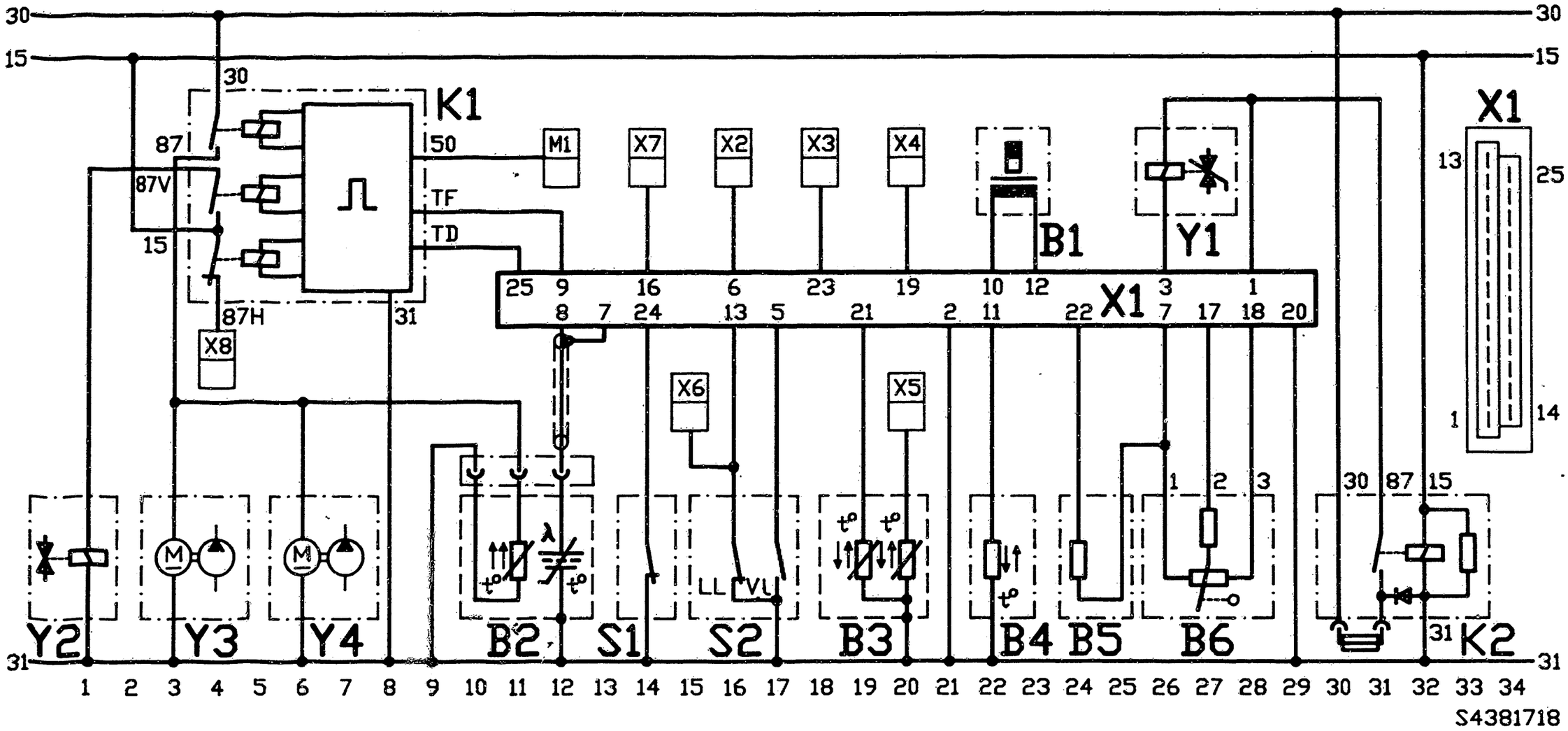


B1 = Pressure actuator
B2 = Lambda sensor
B3 = Temperature sensor (engine)
B4 = Temperature sensor (intake air)
B5 = Trimming plug, map adjustment
B6 = Air-flow-sensor potentiometer
K1 = Electric-fuel-pump relay
K2 = Over-voltage protection relay
M1 = Connection, starting motor, terminal 50
S1 = Microswitch - overrun cutoff
S2 = Throttle-valve switch (full load, idle)

X1 = Plug, KE-control unit
X2 = Speed signal
X3 = Connection, diagnosis socket, pin 3
X4 = to air conditioner
X5 = to ignition trigger box, terminal 1
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch (ground connection with type 201)
Y1 = Idle actuator
Y2 = Start valve
Y3 = Electric fuel pump 1
Y4 = Electric fuel pump 2 (types 124 and 201 only)

ELECTRICAL TERMINAL DIAGRAM (manual transmission)

D21 ⟹
D22 ⟺



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B1 = Pressure actuator
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X8 = to kickdown switch
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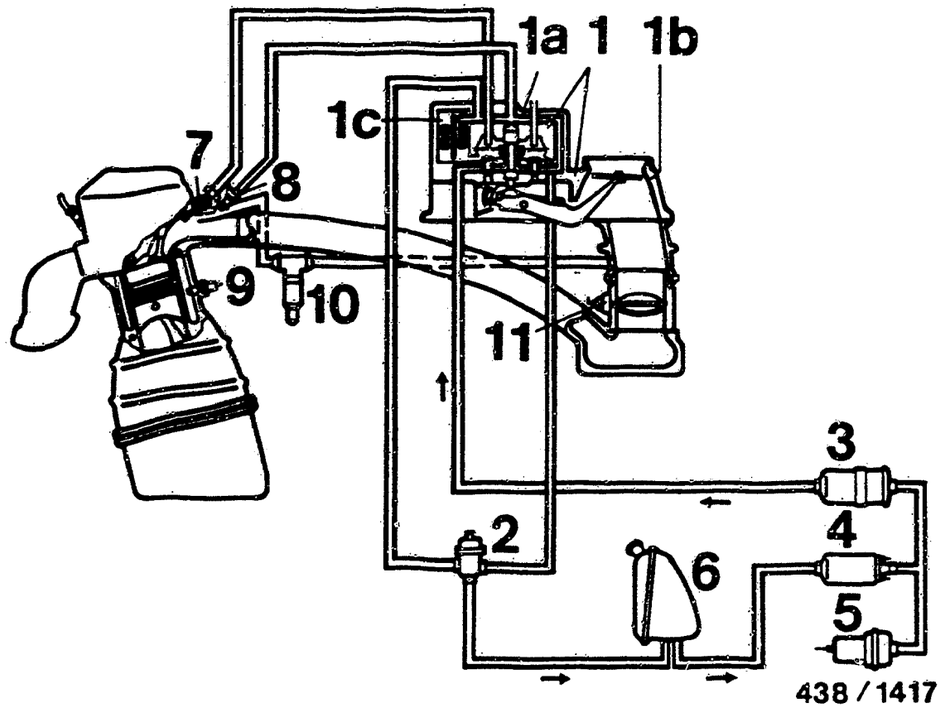
Y3 = Electric fuel pump 1
Y4 = Electric fuel pump 2 (types 124 and 201 only)

ELECTRICAL TERMINAL DIAGRAM (automatic transmission)

D23 —

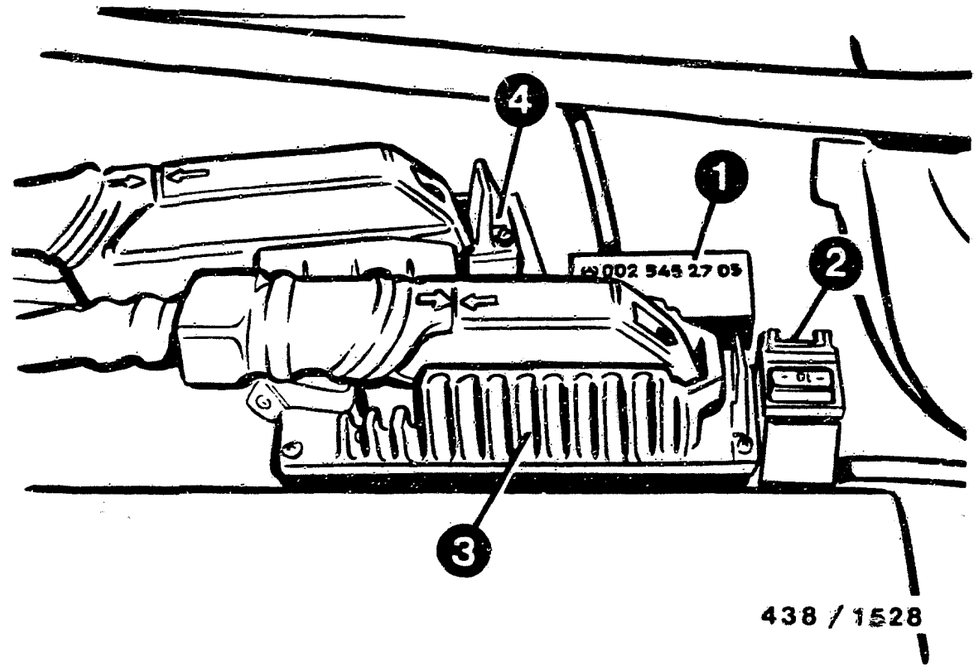
D24 —



438/1417

1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



438/1528

1 = Electronic relay for electric-fuel-pump and cold-start valve actuation

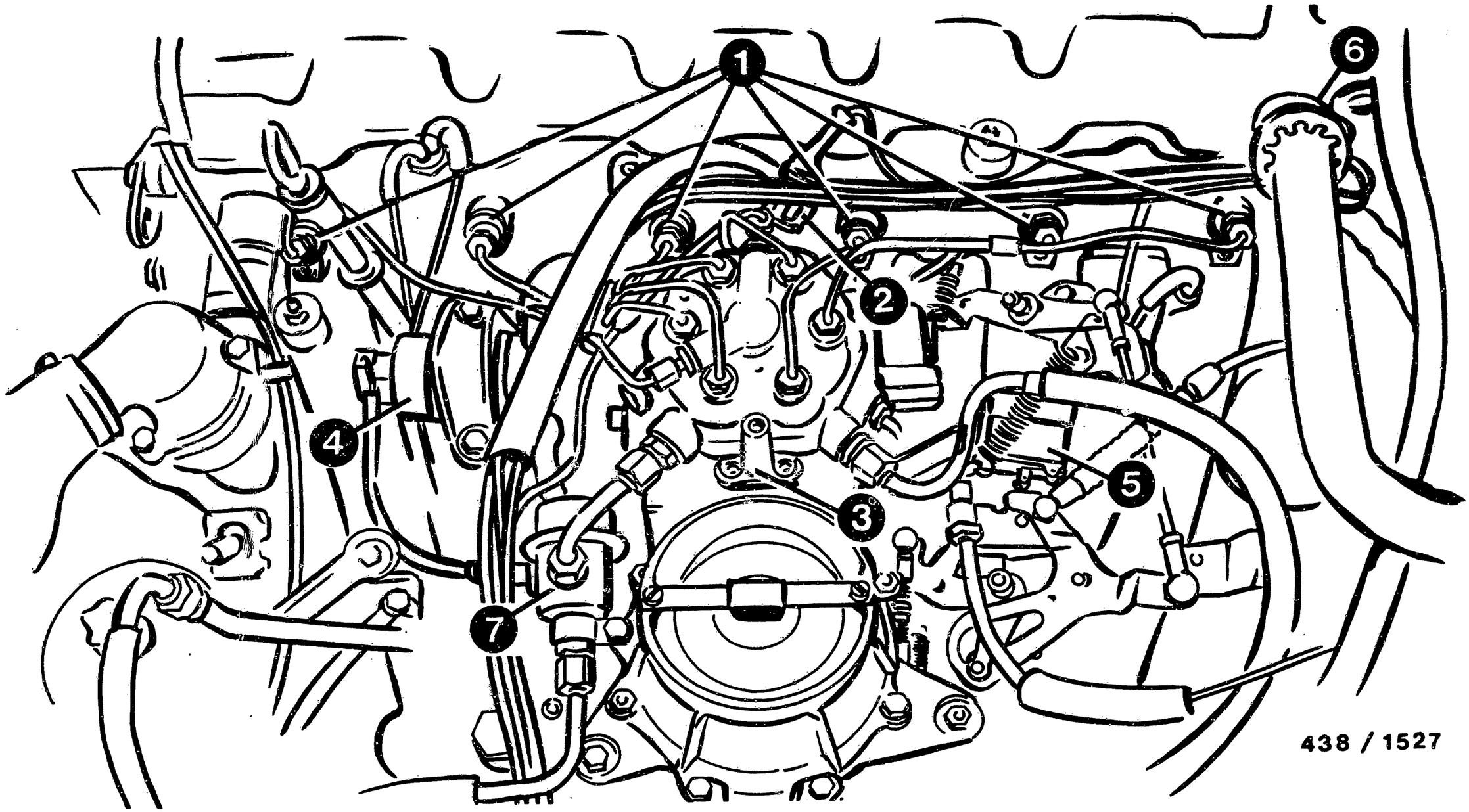
2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

In Type 126, the electric fuel pump relay and the over-voltage protection relay are positioned in the engine compartment on the left.
The KE-Jetronic control unit and the mixture map trimming plug are installed in the footwell on the right behind the side panel in the Type 126.

INSTALLATION POSITION OF COMPONENTS



1 = Fuel-injection valves
2 = Start valve
3 = Mixture-control unit
4 = Idle actuator
5 = Throttle-valve switch, idle (microswitch on accelerator linkage)
6 = Engine-temperature sensor (concealed)
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

Trouble-shooting instructions : MB-5045

BOSCH system : KE Jetronic 3.1

Make of vehicle : MERCEDES-BENZ

Basic microcard : PKW-014

TABLE OF CONTENTS

SPECIAL FEATURES

* These instructions, valid at the time of publication, contain trouble-shooting instructions for the following model:

MERCEDES-BENZ
300E/CE/TE/SE/SEL/SL 3,0l/6-cyl. US/J/AUS 08.87->

* Trouble-shooting employing these instructions may only be performed if the data given in the "Overview of Service Information for Vehicles" (KFZ-0..) coincide with those of the vehicle type and the BOSCH number of the installed KE-Jetronic control unit.

* Electronically controlled idle-speed regulation with single-winding rotary actuator, without bypass adjusting screw.

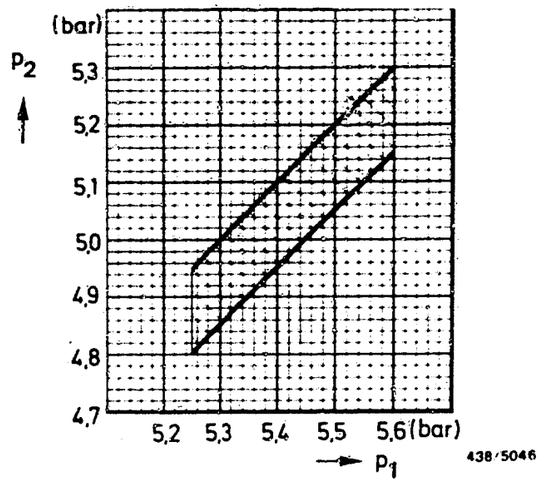
* Active-carbon filter and regeneration valve for returning fuel vapors to intake manifold. (Fuel vaporization system)

* Diagnosis lamp "CHECK ENGINE" lights up as a functional check when switching on the ignition. During engine operation, it indicates failure of the lambda sensor.

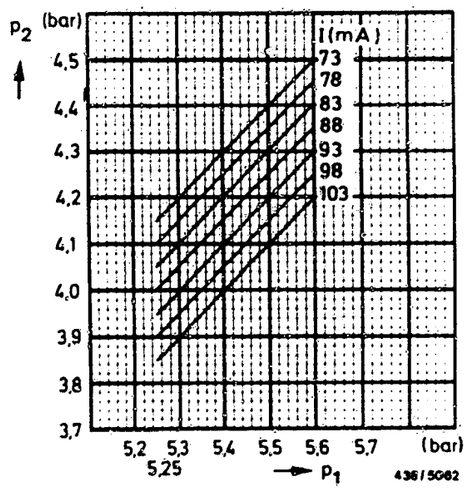
Important information:
If reference is made to a basic microcard, the test specifications are always to be taken from the vehicle-specific brief instructions. Pay attention to safety and precautionary measures outlined in basic instructions, so as to avoid endangering people and to prevent damage to engine, trigger boxes, control units or ignition system.

TEST SPECIFICATIONS

No.	Testing/Test condition	Test specification	
1	Electric fuel pump – fuel delivery:	At least 1400 cm ^{3} /min	
2	Primary pressure:	5,25...5,6 bar	
3	Differential pressure: Suppression of peak coil current: Actuate starting motor with fuel-pump relay disconnected. Do not switch off ignition after starting. Take lower-chamber pressure set value "warm" from top chart corresponding to primary pressure measured. (Actuator current 0 mA) Take lower-chamber pressure set value "cold" from bottom chart corresponding to primary pressure measured and actuator current. Tolerance ± 0.15 bar. Simulation of "cold" state: press push-button 3 at test adapter.		
4	Leakage test, complete system: Minimum pressure after 10 mins: Minimum pressure after 20 mins:	 2,7 bar 2,6 bar	
5	Injection valves, opening pressure:	3,0...4,1 bar	
6	Fuel deliveries, comparative measurement: (Actuator current 0 mA) Idle: Part load: Full load: Min. delivery at max. air-flow sensor plate defl.:	Setting point: (cm ^{3} /min) 6,0 40,0 100,0 140 cm ^{3} /min	Max. permis. delivery: (cm ^{3} /min) 6,6 42,5 109,0



p_1 = Primary pressure
p_2 = Lower-chamber pressure

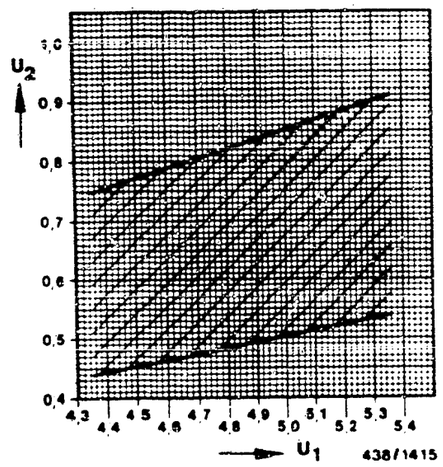


TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
7	Rate of flow, KE restriction:	130...150 cm^3 /min
8	Temperature sensor, air (NTC I): Air temperature +15...+30°C:	 – k Ω
9	Temperature sensor, engine (NTC II): Engine cold (+15...+30°C): Engine warm (approx. +80°C):	 1,3...3,6 k Ω 250...390 Ω
10	Idle-mixture-adjusting screw basic setting. Fuel-distributor seat – needle bearing:	 20,9...21,6 mm
11	Idle adjustment: Low-idle-speed control: adjustment of idle-air quantity not possible. For testing, engine at norm. op. temp. Idle speed: Engage driving position, speed: Check lambda closed-loop control: Measurement with lambda closed-loop control tester (e.g. KDJE-P 600) and adpater lead (e.g. KDJE-P 600/52) at diagnosis socket outlet (pin 3). Alternatively: Current measurement using universal test adapter. Put fuel evaporation system out of operation. Determine on/off ratio (mean value) at n = 2500 min^{-1} . Deviation of on/off ratio (mean value) at idle compared to n = 2500 min^{-1} : Adjustment at idle-mixture-adjusting screw. After adjustment, repeat measurement.	 620...720 min^{-1} 500...600 min^{-1} –10...+10 %

TEST SPECIFICATIONS (CONTINUED)

No.	Testing/Test condition	Test specification
12	Signal, air-flow sensor potentiometer: (Checking necessary when poor idle and/or part-load behavior) Measurement using test adapter and voltmeter. Determine supply voltage of potentiometer: Set value (test adapter, V-position 10): Determine potentiometer signal at idle speed. (Test adapter, V-position 11) Set value corresponding to supply voltage: Adjust signal if necessary at trimming potentiometer (at right next to potentiometer pins). Afterwards, re-secure adjusting screw of trimming potentiometer using black sealing compound (e.g Teroson).	 4,35...5,35 V See chart



U_1 = Supply voltage potentiometer

U_2 = Potentiometer voltage signal

SELF-DIAGNOSIS

All Daimler-Benz 4- and 6-cylinder engines in the current series (approx. 10.85) are equipped with self-diagnosis using on-off ratio measurement.

Incorrect input signals from the KE-Jetronic control unit can be displayed with the lambda closed-loop tester at the lambda test output (diagnosis socket, socket 3).

This provides information on short and open circuits. Defects which occur sporadically (e.g. loose contacts) are not indicated. Output of fault signals has priority over output of the lambda closed-loop signal.

We will not go into the defects which can be indicated in more detail here, since the input signals of the KE-Jetronic control unit can be tested with the universal test adapter (rapid-diagnosis chart).

However, if when testing the lambda closed-loop control by means of on-off ratio measurement, a constant on-off ratio is indicated, then the input signals of the KE-Jetronic control unit should be tested (rapid diagnosis chart).

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 WITH KE3 ADAPTER LEAD 1 684 463 169 AND SUITABLE MULTIMETER:

The following rapid diagnosis chart makes it possible for experienced Jetronic specialists to rapidly check the electrical/electronic peripheral and control-unit functions of the KE-Jetronic including the lambda closed-loop control.

Important information regarding the following rapid diagnosis chart:

The "Test conditions" column indicates the test steps for which the control-unit plug must be connected/detached. Whenever the plug is connected or detached, care is to be taken to ensure that the system is deenergized, i.e. the ignition must be switched off and the electrical safety circuit must not be jumpered.

The "Test connections" column provides information on the connected leads in each measuring path referenced to the assignment in the control-unit plug. Any trouble-shooting measures which may be required relate to these leads.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
1	| V	4	—	Internal resistance (R_1) pressure actuator	12–10	Disconnect control-unit plug.	20...30 Ω
2	| V	5	—	Resistance, temperature sensor (engine)	21– 2	Engine temperature +15...+30°C: approx. +80°C:	1,3...3,6 k Ω 250...390 Ω
3				Resistance, temperature sensor (intake air)		Air temperature in area of NTC I = +15...+30°C:	Test step not applicable
4	| V	6	—	Signal, altitude sensor	11– 2	Connect control unit. Switch on ignition. Voltmeter connection to blue Ω-sockets. Signal altitude-dependent: 0 meters (sea level): 500 meters: 1000 meters: 1500 meters: 2000 meters: 3000 meters:	 3,2...4,5 V 2,8...4,0 V 2,4...3,5 V 2,0...3,0 V 1,6...2,5 V 0,8...1,6 V
5	| V	9	—	Throttle-valve switch, idle	13– 2	Switch off ignition. Disconnect control-unit lead plug. Throttle valve closed: open:	 0...10 Ω > 1000 Ω
6	| V	10	—	Throttle-valve switch, full load	5– 2	Throttle valve closed: fully open:	> 5000 Ω 0...10 Ω
7	| V	11	—	Microswitch idle linkage	24– 2	Throttle valve closed: open:	0...10 Ω infinite Ω
8	| V	12	—	Ground, control unit	20– 2		0...10 Ω
9	| V	13	—	Ground, pin 7	7– 2	Switch off ignition. Connect control unit.	0...10 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
10	⊥ V	14	–	Trimming plug mixture map	22– 2	Disconnect control-unit plug. Disconnect lead plug from air-flow sensor potentiometer and connect socket 1 of plug (in upper installation position) to engine ground. Trimming-plug position 1: 2: 3: 4: 5: 6: 7:	 – Ω – Ω – Ω – Ω – Ω – Ω – Ω
11	⊥ V	15	–	Transmission switch (automatic transmission only)	16– 2	Connect air-flow sensor potentiometer. Selection lever position P,N: Driving position selected:	 0...10 Ω infinite Ω
12	5	–	–	TD signal	25– 2	Start engine (starting motor):	Voltage undefined
13	6	–	–	Control-unit supply	1– 2	Switch on ignition:	8...15 V
14	7	–	–	Idle actuator supply and continuity	3– 2	Switch on ignition:	8...15 V
15	8	–	–	Speed signal	6– 2	Drive vehicle on chassis dynamometer or road:	Voltage undefined
16	9	–	–	Air-conditioner cut-in signal	19– 2	Switch off ignition. Connect control unit. Start engine, switch on air conditioner. Temperature regulator = minimum temperature	 8...15 V
17	10	–	–	Supply, air-flow sensor potentiometer	18– 2	Switch on ignition:	4,35...5,35 V

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
18	11	–	–	Signal, air-flow sensor potentiometer	17– 2	Switch on ignition. Air-flow sensor plate in neutral position: Deflect air-flow sensor plate by hand, continuous rise up to max.:	0 V 5,35 V
19	13	–	1	Temperature signal from control unit	9– 2	Switch on ignition. While actuating btn 1:	1,5...1,9 V
20	14	–	–	Consumption signal	4– 2	Start engine – idle: With regulation:	Voltage undefined Voltage change
21	–	–	–	Peak coil current	12–12	Switch on ignition:	->FD —— : —— mA FD 746–>: 18...22 mA
22	–	21	1	Warm-up enrichment + 20° C	12–12	Warm up engine – idle. Current value with btn 1 pressed:	->FD —— : —— mA FD ——>: —— mA
23	–	24	2	Actuator current engine at normal operating temperature	12–12	Engine at normal operating temperature, idle. Current value with btn 2 pressed; reading oscillating, mean value:	->FD —— : —— mA FD 746–>: –1...+1 mA
24	–	21	2	Starting enrichment	12–12	So that engine fails to start: Disconnect speed relay for electric fuel pump. Short circuit ignition coil term.4 to ground via resistance of at least 2k Ω . (e.g. with sleeve-type suppressor and spark gap) While btn 2 pressed, actuate starting motor. Current rise (max. 1 sec.) to:	->FD —— : —— mA FD 746–>: 40...60 mA

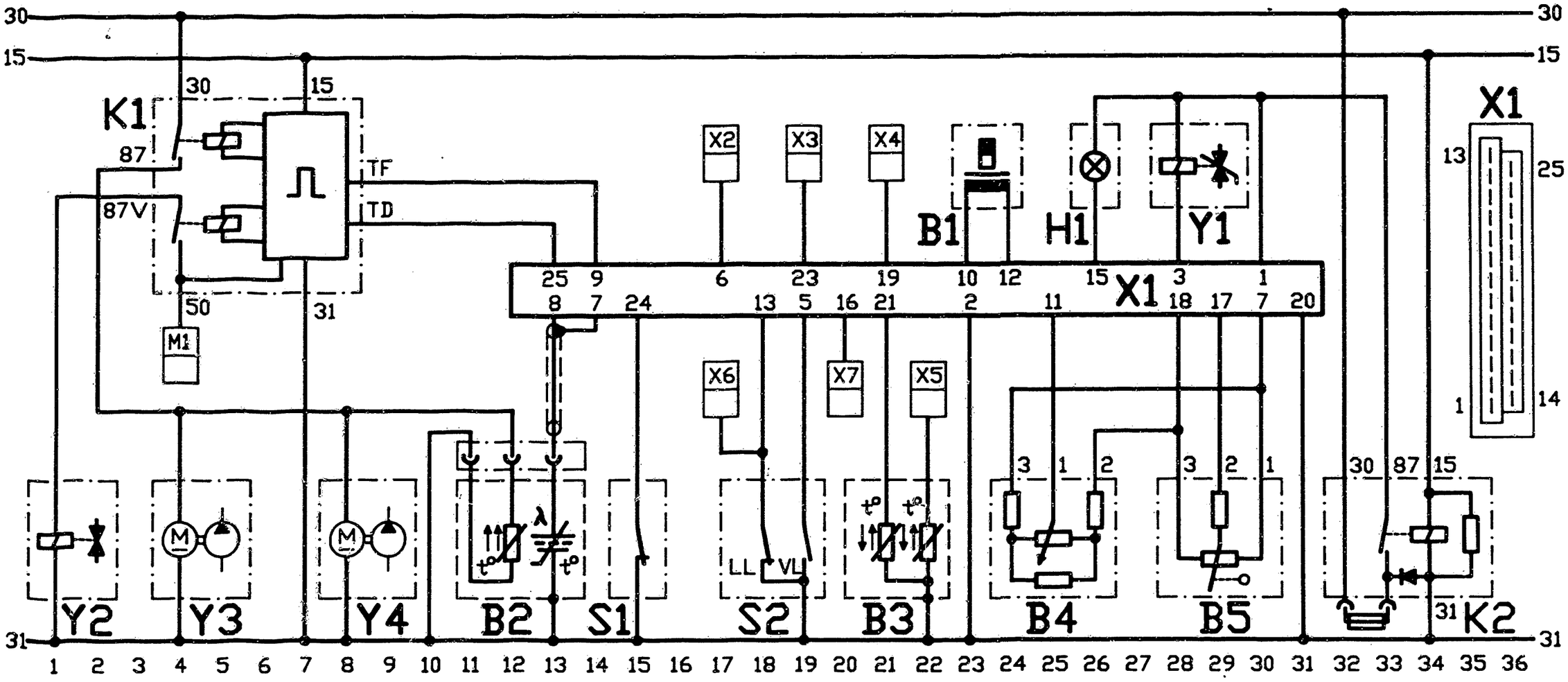
FD = Date of manufacture

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specifications
25	–	21	1	Post-start enrichment	12–12	Start engine (at normal operating temperature) while actuating btn 1. Current value: Current value constant for a few seconds, then slow speed regulation.	–>FD —— : —— mA FD 746–>: 22...26 mA
26	–	21	1	Acceleration enrichment	12–12	Engine at normal operating temperature, idle. While actuating btn 1, perform snap acceleration of engine. Thus current rise (approx. 1 sec.) to: Note: Level of current value dependent upon intensity of acceleration (travel/duration of air-flow sensor plate movement).	–>FD —— : —— mA FD 746–>: 40...70 mA
27	–	–	–	Overrun cut-off	12–12	Re-connect ohmmeter (swap positive and negative). Start engine (normal operating temperature). Drive vehicle on chassis dynamometer or road. Increase speed n briefly to at least approx.: Current reading during falling speed phase: (idle throttle-valve switch closed)	–>FD —— : —— min $^{-1}$ FD 746–>: 2000 min $^{-1}$ –40...–80 mA

FD = Date of manufacture

No.	Switch/Btn V	Ω	Btn	Under test	Test pins	Test conditions	Test specification CAT
28	–	24	–	Full-load enrichment	12-12	Engine at normal operating temperature, idle. Reading oscillating, mean value: Briefly push accelerator pedal to floor (full-load throttle-valve switch must switch). During speed rise, current value rises by: A t t e n t i o n: Do this very briefly, so that speed does not rise too much and engine is not damaged.	 ->FD ——: —— mA FD 746 ->: -1...+1 mA ->FD ——: —— mA FD 746 ->: 5...11 mA
29	–	21	–	Lambda closed-loop control, open-loop control mode	12-12	Disconnect regeneration lead to throttle-valve assembly at generation valve and seal. Engine at norm. op. temp., idle. Current value:	 -1...+1 mA
30	–	24	–	Lambda closed-loop control, closed-loop control mode	12-12	Engine at norm. op. temp., idle. Closed-loop control mode can be recognized from the oscillating current reading. Mean value: If mean value outside tolerance, set (idle-mixture-adjusting screw) to approx.:	 -1...+1 mA 0 mA
31	–	22	–	Lambda closed-loop control, rich stop	12-12	Engine at norm. op. temp., idle. Current rise to:	 12...16 mA
32	–	23	–	Lambda closed-loop control, lean stop	12-12	Engine at norm. op. temp., idle. Current drop to:	 -8...-12 mA

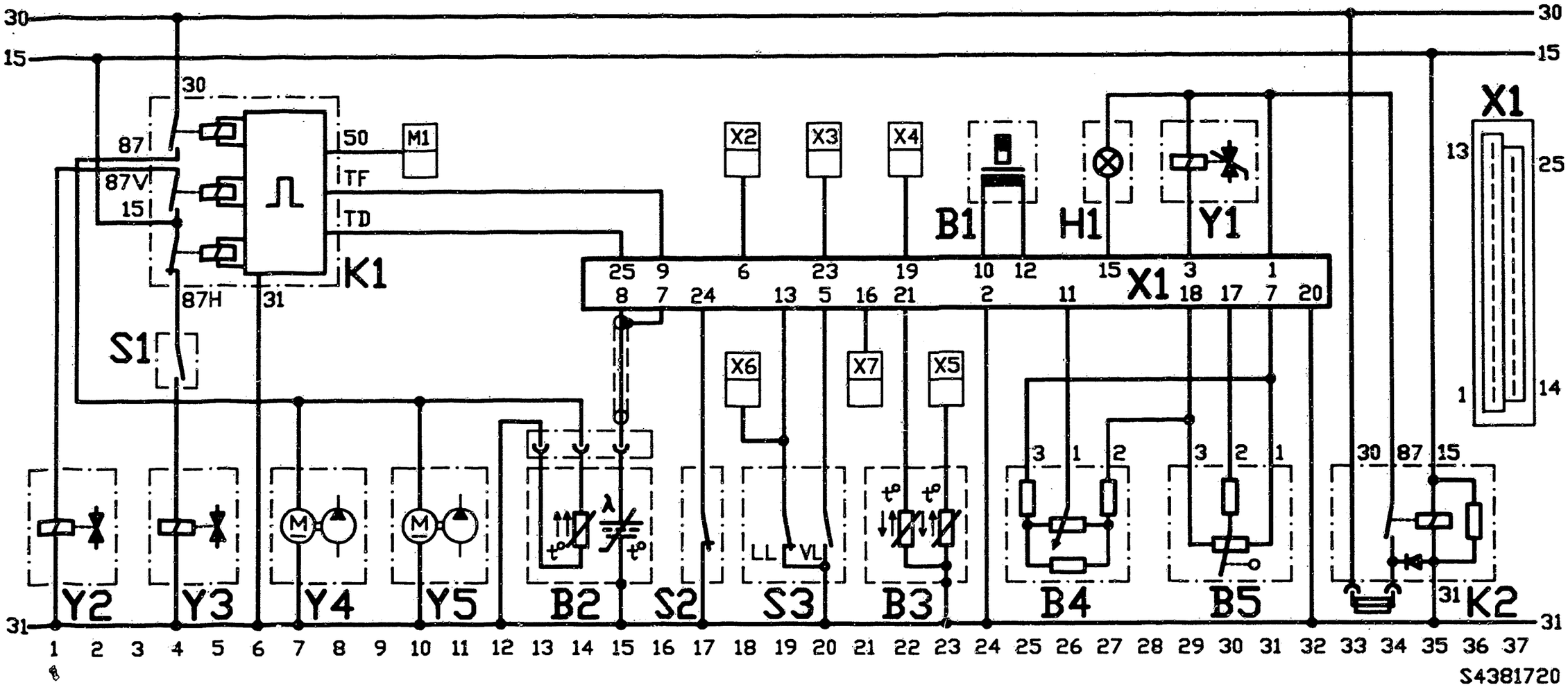
*) FD = Date of manufacture



B1 = Pressure actuator
B2 = Lambda sensor
B3 = Temperature sensor (engine)
B4 = Altitude sensor
B5 = Air-flow-sensor potentiometer
H1 = Diagnosis lamp (CHECK ENGINE)
K1 = Electric-fuel-pump relay
K2 = Over-voltage protection relay
M1 = Connection, starting motor, terminal 50
S1 = Microswitch - overrun cutoff
S2 = Throttle-valve switch (full load, idle)

X1 = Plug, KE-control unit
X2 = Speed signal
X3 = Connection, diagnosis socket, pin 3
X4 = to air conditioner
X5 = to ignition trigger box, terminal 1
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch
Y1 = Idle actuator
Y2 = Start valve
Y3 = Electric fuel pump 1
Y4 = Electric fuel pump 2 (type 124 only)

ELECTRICAL TERMINAL DIAGRAM (manual transmission)



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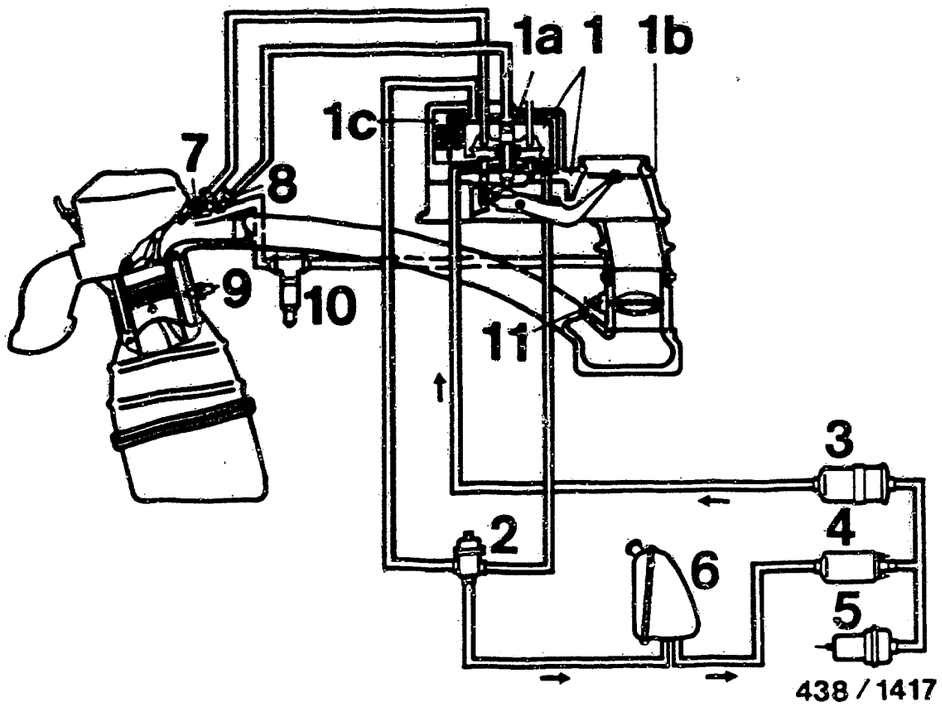
B2 = Lambda sensor
B3 = Temperature sensor (engine)
B4 = Altitude sensor
B5 = Air-flow-sensor potentiometer
H1 = Diagnosis lamp (CHECK ENGINE)
K1 = Electric-fuel-pump relay
K2 = Over-voltage protection relay
M1 = Connection, starting motor, terminal 50
S1 = Kickdown switch
S2 = Microswitch - overrun cutoff
S3 = Throttle-valve switch (full load, idle)

X1 = Plug, KE-control unit
X2 = Speed signal
X3 = Connection, diagnosis socket, pin 3
X4 = to air conditioner
X5 = to ignition trigger box, terminal 1
X6 = to ignition trigger box, terminal 2
X7 = to gear-shift switch
Y1 = Idle actuator
Y2 = Start valve
Y3 = Change-over valve
Y4 = Electric fuel pump 1
Y5 = Electric fuel pump 2 (type 124 only)

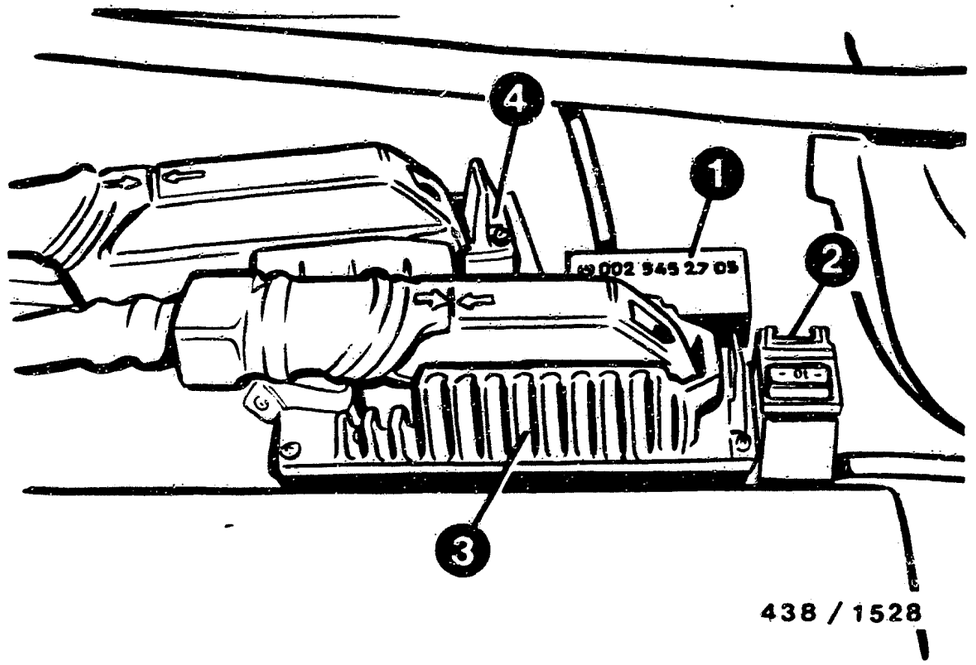
ELECTRICAL TERMINAL DIAGRAM (automatic transmission)



438 / 1417

1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Pressure regulator, primary pressure
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Cold-start valve
9 = Temperature sensor engine (Double NTC)
10 = Idle actuator
11 = Throttle-valve switch, idle/full load

DIAGRAM OF AIR AND FUEL LINES



438 / 1528

1 = Electronic relay for electric-fuel-pump and cold-start valve actuation

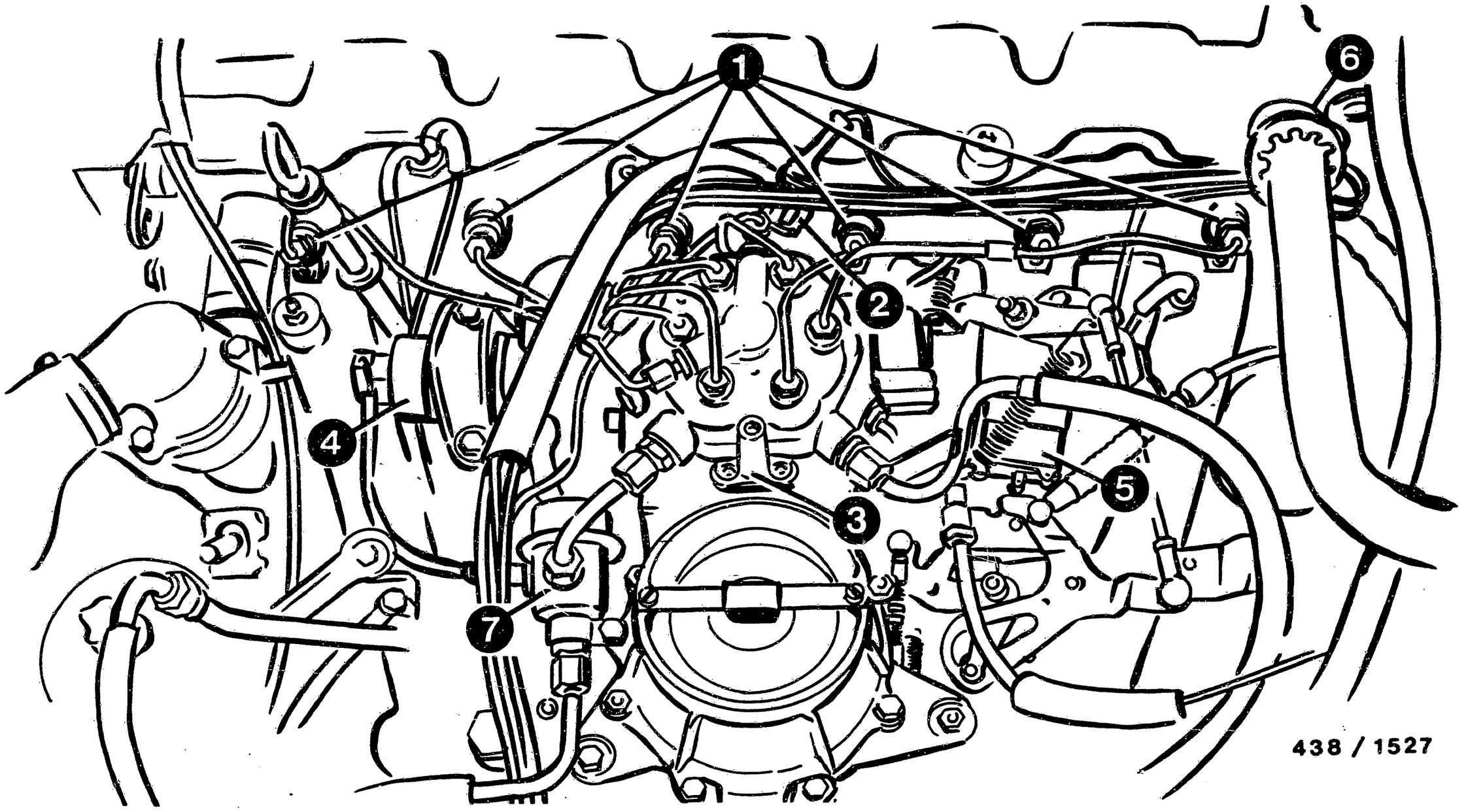
2 = Over-voltage protection relay

3 = KE-Jetronic control unit

4 = ABS controller (if present)

In Type 126, the electric fuel pump relay and the over-voltage protection relay are positioned in the engine compartment on the left.
The KE-Jetronic control unit and the mixture map trimming plug are installed in the footwell on the right behind the side panel in the Type 126.

INSTALLATION POSITION OF COMPONENTS



1 = Fuel-injection valves
2 = Start valve
3 = Mixture-control unit
4 = Idle actuator
5 = Throttle-valve switch, idle (microswitch on accelerator linkage)
6 = Engine-temperature sensor (concealed)
7 = Pressure regulator

INSTALLATION POSITION OF COMPONENTS

Trouble-shooting instructions : OPE-5014

BOSCH system : TI-I

Make of vehicle : OPEL

Basic microcard : PKW- 105

TABLE OF CONTENTS

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Opel models:

Corsa A, with 1.2 l and 1.3 l/ 4-cyl. engine 9.86 ->.
Engine versions: 12 ST, A 12 ST, E 12 GV, 13 SD, 13 SB

Kadett E, with 1.2 l und 1.3 l/ 4-cyl. engine 9.86 ->.
Engine versions: A 12 ST, 13, 13 S, A 13 S 13 N

Ascona C, with 1.3 l/ 4-cyl. engine 9.87 ->
Engine versions: 13, 13 S

* Trigger box 0 227 100 123 (with current limitation)
* Ignition coil 1 227 020 024
* Ignition coil with trigger box 0 221 600 052
* Engine E 12 GV with overrun cutoff or temperature-dependent vacuum-advance-unit cutoff.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*			*								High-tension side
*											Firing sequence
*			*								Ignition coil
*											Trigger-box voltage
*											Primary-circuit voltage
*											Mechanical damage Magnetic pulse generator
*											Internal resistance, magnetic pulse generator
*											Insulation, magnetic pulse generator
*											Voltage - polarity, magnetic pulse generator
*											Contact resistance (primary side)
*											Primary signal
*		*	*		*	*		*	*		Ignition point and advance
				*							Trigger-box voltage (engine idling)
				*							Ignition-coil voltage (engine idling)
*											Peak-coil-current cutoff

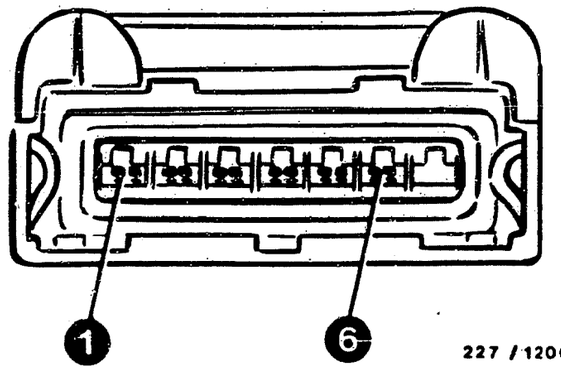
TROUBLE-SHOOTING CHART (CONTINUED)

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Idle problems (engine speed, exhaust gas).	4. Poor throttle take-up, flat spot during acceleration.	5. Engine missing (ignition, injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
			*								Primary voltage (engine idling)

RAPID DIAGNOSIS CHART

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
1	HIGH-TENSION SIDE Check function of for example spark plugs, ignition harness, distributor cap (e.g. open-circuit, shunt). Assess, for example, by way of ignition oscillogram, resistance measurement, visual inspection	——	——
2	IGNITION COIL Visual inspection: plug in position, sealing compound leaked? Primary resistance Secondary resistance	 1 15 1 4	 0,7... 1,2 Ω 6,9...11,9 k Ω
3	TRIGGER-BOX VOLTAGE Detach trigger-box plug. Refer to Fig. Ignition ON. Voltage of trigger-box plug.	 4 (+) 2 (−)	 Battery voltage
4	PRIMARY CIRCUIT VOLTAGE Trigger-box plug detached. Refer to Fig. Ignition ON. Voltage of trigger-box plug.	 1 (+) 2 (−)	 Battery voltage
5	MECHANICAL DAMAGE, MAGNETIC PULSE GENERATOR Visual inspection: timer core must not catch on teeth of magnetic pulse generator.	——	——

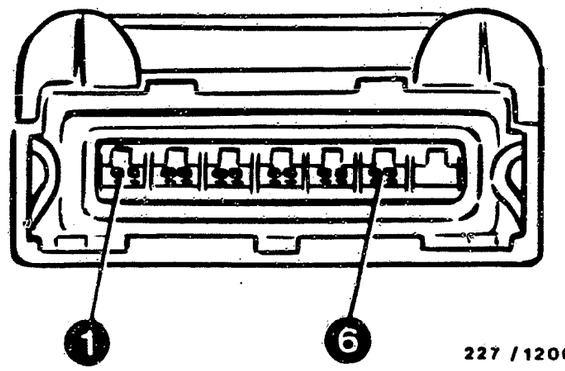


227 /1200

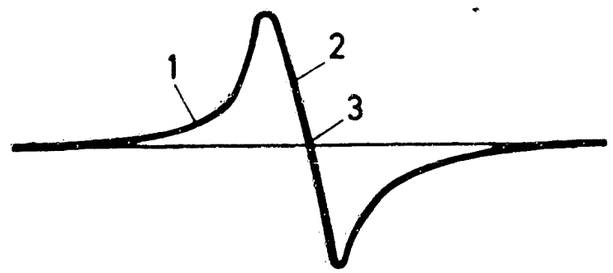
F07 —— ⟹

F08 —— ⟺

Test step	Testing of component/function Test instructions/conditions	Term-inals	Set values
6	INTERNAL RES. OF MAGNETIC PULSE GENERATOR Trigger-box plug detached. Refer to top Fig. Resistance of trigger-box plug.	 5 6	 495...820 Ω
7	MAGNETIC-PULSE-GENERATOR INSULATION Trigger-box plug detached. Refer to top Fig. Resistance of trigger-box plug and vehicle ground.	 5 B-	 infinity Ω (open-circuit)
8	VOLTAGE - POLARITY, MAGNETIC PULSE GENERATOR Trigger-box plug detached. Refer to top Fig. Connect oscill. "special" to trigger-box plug Start engine. NOTE: Correct polarity starts with positive half-wave and shallow rise.	 5 6 (+) (-)	 See note/bottom Fig. as regards polarity.
9	CONTACT RESISTANCE (PRIMARY SIDE) Detach negative - positive lead from battery. Trigger-box plug detached. Refer to top Fig. Ignition ON. Resistance from battery terminal to trigger-box plug. Resistance from battery terminal to ignition coil. Resistance from ignition coil to trigger-box plug.	 B+ 4 B- 2 B+ 15 1 1	 0.3 Ω max. 0.3 Ω

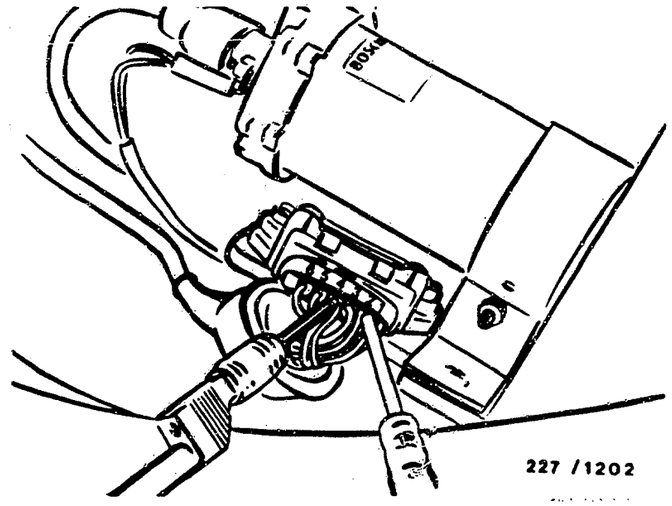


227 /1200



227/1201

Test step	Testing of component/function Test instructions/conditions	Terminals	Set values
10	PRIMARY SIGNAL Attach trigger-box plug. Connect oscilloscope/engine-speed tester to ignition coil. Start engine.	15 1 (+) (–)	Primary voltage/ engine-speed display (magnitude irrelevant)
11	IGNITION POINT AND ADVANCE Connect motortester in accordance with operating instructions.	——	See test specifications (e.g. Autodata)
12	TRIGGER-BOX VOLTAGE Push back rubber sleeve of trigger-box plug. Voltage, trigger-box plug. Refer to Fig. Engine idling.	4 2 (+) (–)	12–14 V, max. 1 V less than U_B
13	IGNITION-COIL VOLTAGE Ignition-coil and battery voltage. Engine idling.	15 B– (+) (–)	Equal to/greater than 10 V
14	PEAK-COIL-CURRENT CUTOFF Ignition-coil voltage. Ignition ON.	15 1 (+) (–)	after approx. 1 s 0 V
15	PRIMARY VOLTAGE Connect oscilloscope with pulse-shaping circuit to ignition coil. Engine idling.	15 1 (+) (–)	290...400 V



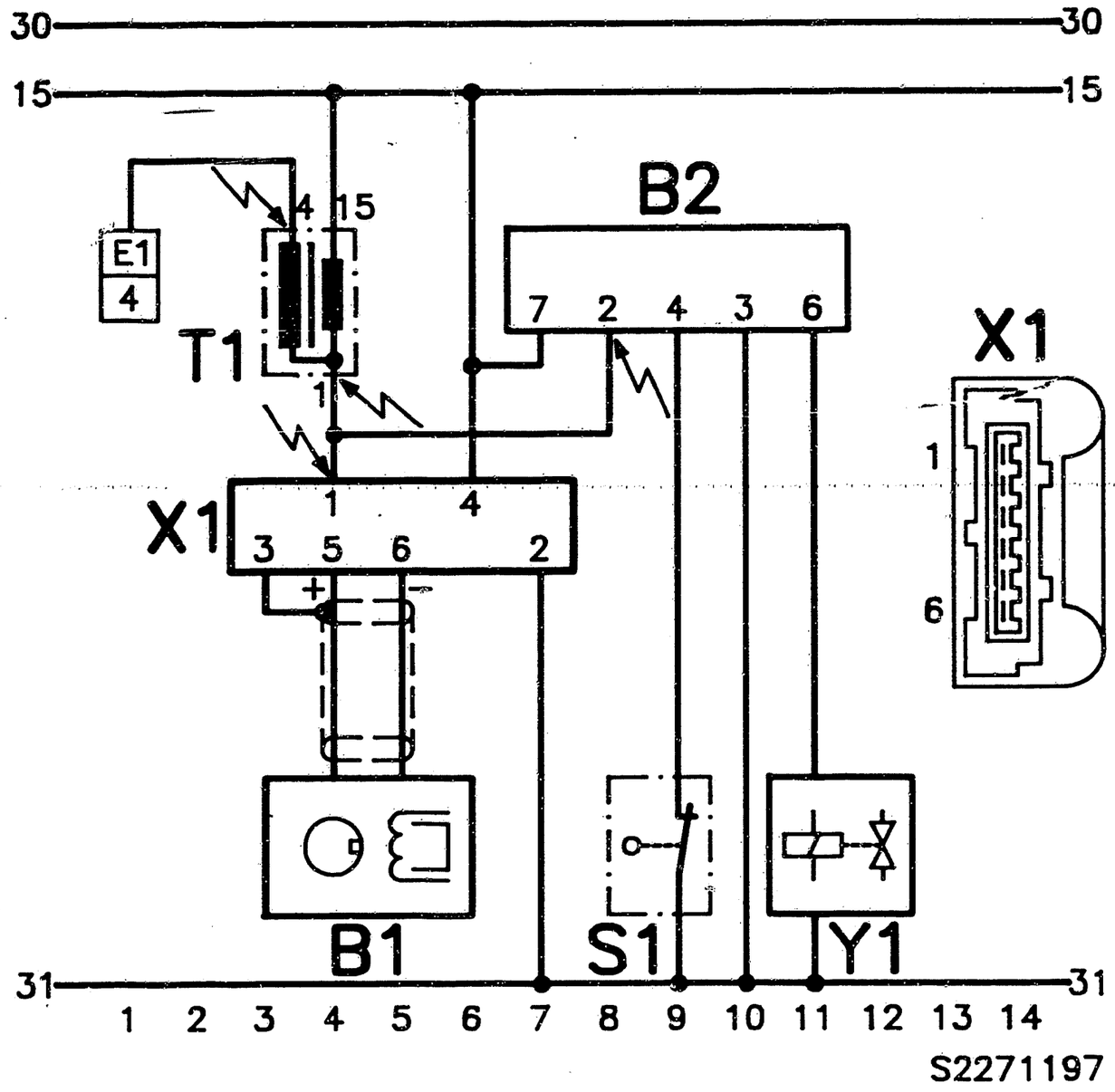
TEST SPECIFICATIONS

Ignition coil, primary	0,7... 1,2 Ω
Ignition coil, secondary	6,9...11,9 k Ω
Trigger-box voltage with ignition ON	Battery voltage
Primary-circuit voltage with ignition ON	Battery voltage
Internal resistance Pulse generator	495...820 Ω
Pulse-generator insulation	infinity Ω
Pulse-generator voltage at cranking speed	Correct polarity starts with positive half-wave and shallow rise
Contact resistance Supply lines Trigger box/ Primary circuit	max. 0,3 Ω
Primary signal at cranking speed	Primary voltage/ engine-speed display
Ignition point and advance	Test specifications e.g. Autodata
Trigger-box voltage with engine idling	12...14 V max. 1 V less than U_B
Ignition-coil voltage with engine idling	Equal to/greater than 10 V
Primary voltage with engine idling	290...400 V

TEST SPECIFICATIONS (CONTINUED)

Peak-coil-current cutoff after approx. 1 s with ignition ON	0 V

Please refer to Autodata test specifications as regards settings for idling speed, exhaust gas, valve clearance etc.



High-tension arrows: Caution 400 V...25 kV

B1 = Pulse generator (ignition distributor)
B2 = Engine-speed relay (overrun cutoff)
E1 = Ignition distributor

S1 = Throttle-valve switch, idle
T1 = Ignition coil
X1 = Trigger-box plug
Y1 = Overrun-cutoff valve

ELECTRICAL TERMINAL DIAGRAM

F15 ⟹

F16 ⟸

INSTALLATION POSITION OF COMPONENTS

Trigger box and ignition coil:
At wheel house, front left.

Engine-speed relay (overrun cutoff) only
with Corsa A with E 12 GV engine:
At wheel house, front left.

For production reasons:
continued on the following
coordinate.

Trouble-shooting instructions: POR-5007

BOSCH system : K-Jetronic

Make of vehicle : Porsche

Similar detailed instructions: MB 03/J1

TABLE OF CONTENTS

SPECIAL FEATURES

These instructions, valid at the time of publication, contain trouble-shooting instructions for the K-Jetronic on the following Porsche models:

911-Turbo, all country versions without lambda closed-loop control,
as of start of series production (Model 1975).

Engine type designations and assignment to country versions:
(Note: RoW= Rest of World, excluding USA)

930/50, 3.0 l, 191kW/260bhp, M. 75/76	Europe
930/51, 3.0 l, 180kW/245bhp, M. 76	USA
930/52, 3.0 l, 191kW/260bhp, M. 77	RoW
930/53, 3.0 l, 180kW/245bhp, M. 77	USA
930/54, 3.0 l, 180kW/245bhp, M. 77	Japan
930/60, 3.3 l, 221kW/300bhp, M. 78-82	RoW
930/61, 3.3 l, 195kW/265bhp, M. 78-82	USA
930/62, 3.3 l, 195kW/265bhp, M. 78-82	Japan
930/63, 3.3 l, 192kW/261bhp, M. 78-82	Califor.
930/66, 3.3 l, 221kW/300bhp, M. as of 83	RoW

Special features of the K-Jetronic:

* Fuel distributor in 8-cylinder version, 2 outlets sealed.
* Fuel distributor with push valve only as of Model 76.
* Auxiliary-air device only as of Model 76.
* 2 electric fuel pumps for high delivery level and high system pressure.
* Warm-up regulator: up to and including Model 77, version for vacuum-controlled full-load enrichment. As of Model 78, version for full-load enrichment as a function of charge-air pressure.

SPECIAL FEATURES (CONTINUED)

* Model 75 only: air-flow sensor with flanged-on warm-start solenoid for acting on sensor-plate lever to increase warm-start delivery.

Engine equipment:

* The engine of the Porsche 911-Turbo is equipped with a turbocharger and charge cooler.

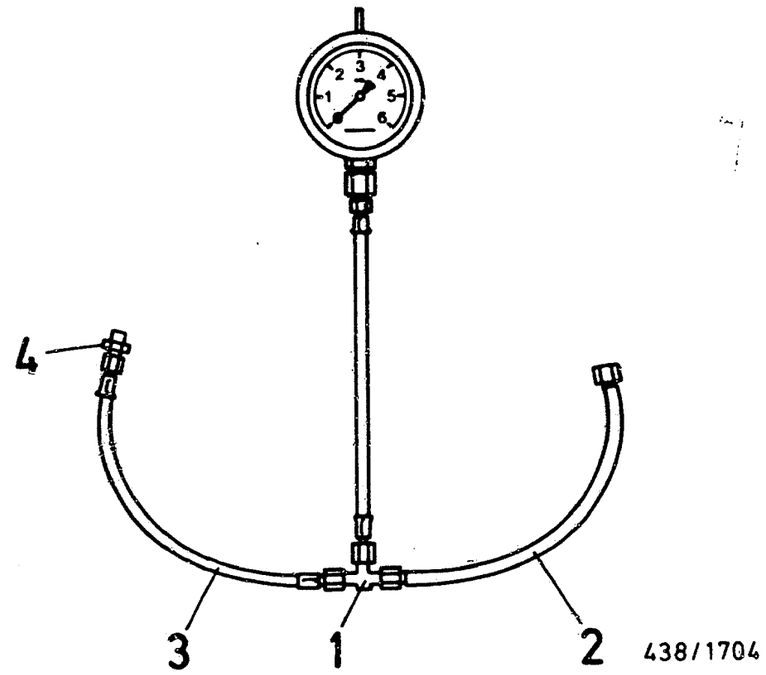
* As of Model 76 all versions are fitted with a secondary air pump for secondary air injection.

* The engine versions 930/51, 53 and 54 (USA, Japan) feature 2 reactors in the exhaust system, with the 930/53 and 54 additionally being provided with exhaust-gas recirculation.

* The engines equipped with reactors additionally feature a thermo-valve and an auxiliary-air valve.

When performing trouble-shooting on the vehicle, attention is to be paid to the function of the supplementary equipment and its effect on the running behavior of the engine.

The auxiliary systems and their functions are explained in detail as of Coordinate 21 on the basis of a schematic representation of the entire air system.

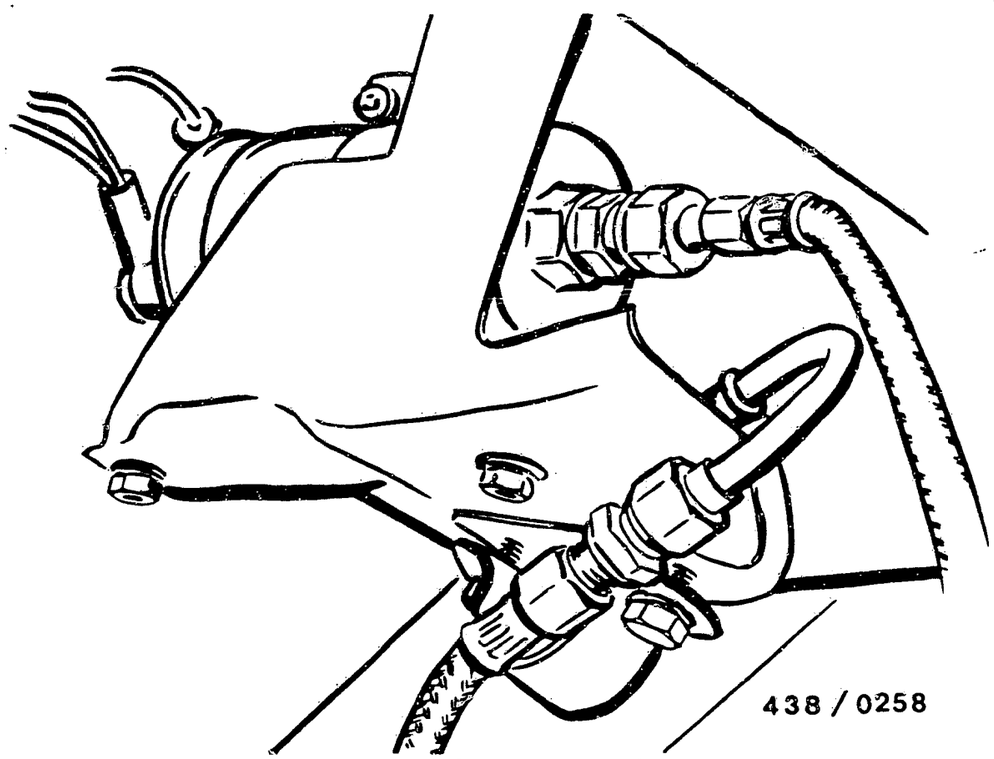


SPECIAL TOOLS, USAGE

On account of the high system pressure (6.0...6.7 bar gauge) use must be made of the version of the pressure measuring device KDJE-P 100 with pressure gauge 0...10 bar gauge. Connection for the usual pressure measurements with connection parts from the Jetronic case KDJE-K 100.

The pressure measuring device KDJE-P 100 is also required for pressure measurement in the fuel line between the two electric fuel pumps. For this purpose, the device is to be converted as shown. Parts required:

1 = Commercially available tee union M 12x1.5 (e.g. Ermeto).
2 = Commercially available hose approx. 30 cm, with ball-type connections M 12x1.5/M 14x1.5.
3 = Hose from KDJE-P 100 with ball-type connections M 12x1.5.
4 = Commercially available threaded double connector M 12x1.5/M 14x1.5.



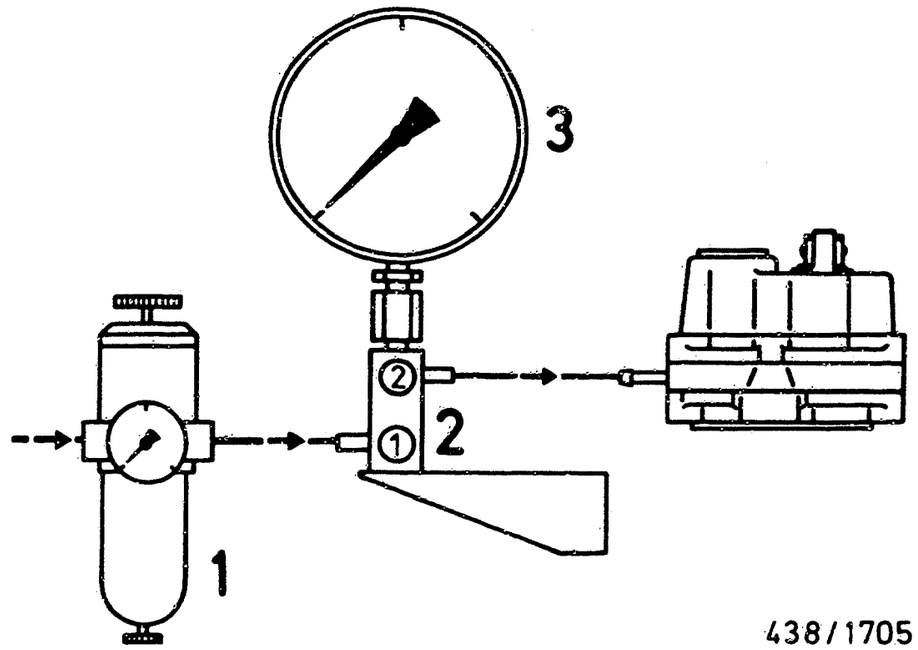
438 / 0258

SPECIAL TOOLS, USAGE (CONTINUED)

The pressure measurement is required to determine the defective pump should the overall delivery from the two electric fuel pumps not be sufficient. Procedure:

Jack-up vehicle and unscrew supply line of electric fuel pump 2 (on bottom of vehicle in front of left-hand rear wheel). Catch fuel emerging. Connect converted pressure measuring device to unscrewed line and to pump inlet (picture).

Switch on electric fuel pumps. Reading on pressure gauge must be between 2 and 4 bar gauge. Electric fuel pump 1 is defective if the value is less than 2 bar gauge; electric fuel pump 2 is defective if the reading is in excess of 4 bar gauge.



438/1705

SPECIAL TOOLS, USAGE (CONTINUED)

Air pressure corresponding to charge-air pressure must be applied to the warm-up regulator in order to test the full-load control pressure in the case of warm-up regulators for full-load enrichment as a function of charge-air pressure. Pressure is to be applied from the workshop compressed-air network using a suitable precision adjustment facility. The facility shown as an example in the picture is often already available in workshops:

1 = Commercially available pressure-reducing valve with pressure gauge 0...4 bar gauge.
2 = Bosch adjusting throttle 0 688 130 132.
3 = Commercially available pressure gauge 0...1.6 bar gauge, quality class 1.0 (e.g. Wika No. 4184).

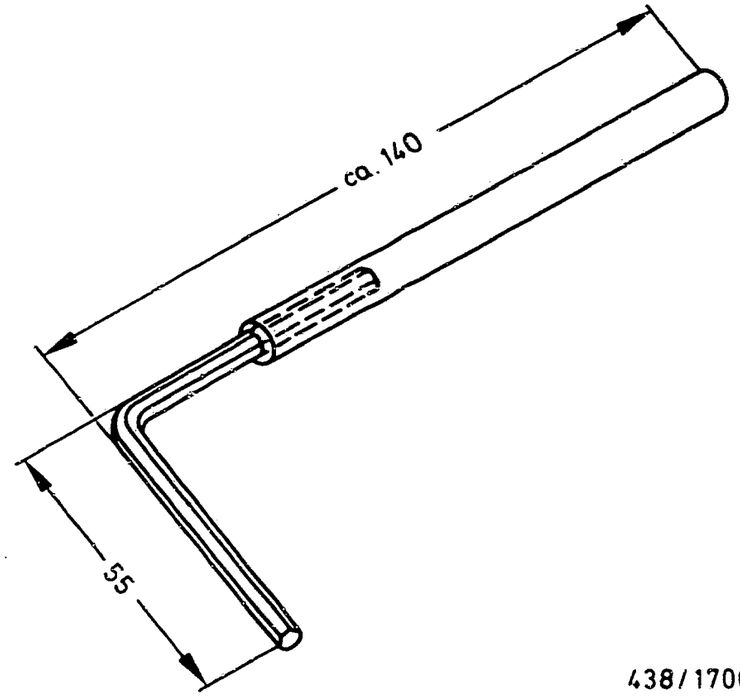
Warm-up regulator connection as shown in picture. Set pressure-reducing valve to approx. 1 bar gauge to apply pressure. Test pressure setting as per test specifications at valves 1 and 2 of adjusting throttle.

SPECIAL TOOLS, USAGE (CONTINUED)

Important note concerning full-load control-pressure test described above:

The maximum permissible test air pressure for the warm-up regulator is 1.5 bar gauge. Use of a higher pressure might destroy or pre-damage the full-load diaphragm of the warm-up regulator.

Testing of the full-load control pressure should always be incorporated into trouble-shooting. As a final step, tightly attach air-pressure hose to warm-up regulator. An undetected defect in the warm-up regulator or a loose hose can result in extremely serious engine damage.



438/1706

SPECIAL TOOLS, USAGE (CONTINUED)

As of Model 78 adjustment of the idle-mixture-adjusting screw requires an extra-long wrench for the 3 mm hexagon-socket-head cap screw.

Use can either be made of a commercially available wrench or a self-produced wrench made in accordance with the dimensions given in the picture.

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart gives an indication of various causes/ component faults.
The general test work specific to the K-Jetronic is described in detail in the similar comprehensive instructions indicated.

NOTE: Even if reference is made to basic instructions, the set values, terminal assignments and special features outlined in these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to general safety instructions for working on engines and Jetronic systems (refer for example to basic instructions), so as to avoid personal injury and prevent engine and auxiliary-system damage.

CAUTION: High-powered ignition system with hazardous high and low voltages! Coming into contact with parts or terminals which carry voltage can be fatal (on both primary and secondary side).

When performing test work with the electric fuel pump running, never deflect (press down) the sensor plate, as this causes fuel to be injected via the injection valves. Such a course of action may result in extremely serious engine damage when subsequently starting the engine.

To prevent fuel injection, both actuation relays for the electric fuel pump are to be detached when testing compression.

TROUBLE-SHOOTING CHART

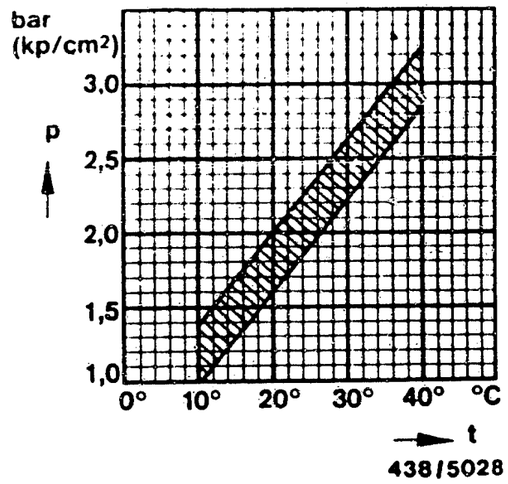
Customer complaint (fault symptoms)

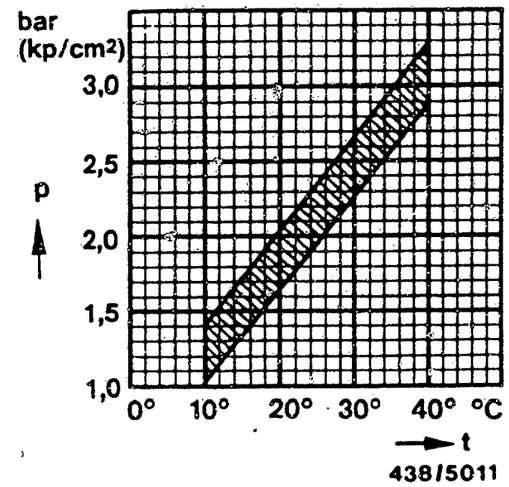
1. Starting motor operates, engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Idle problems (engine speed, exhaust gas).
4. Poor throttle take-up, flat spot during acceleration.
5. Engine missing (ignition, injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.

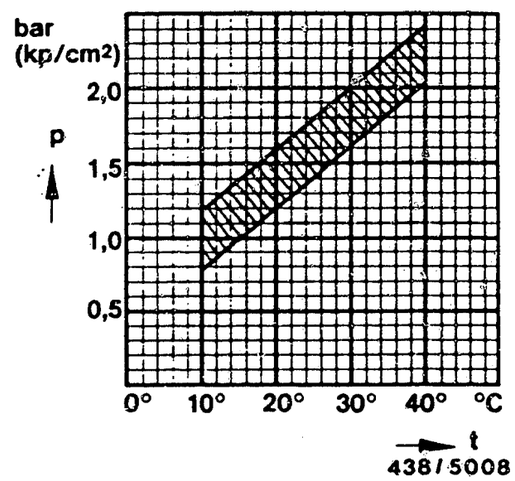
1	2	3	4	5	6	7	8	9	10	Cause (component fault)
*	*			*	*					Electric fuel pump(s), delivery
*	*	*	*		*					Induction system
*	*		*				*			Fuel distributor (mechanical)
						*				Fuel distributor (min. delivery)
*		*	*	*	*	*		*		Fuel distrib. (delivery scatter)
*	*				*		*			Air-flow sensor (mechanical)
*							*			Air-flow sensor (sens.-plate pos.)
*	*	*				*	*			Cold-start system
*	*	*		*	*		*			Injection valves
*	*						*			System pressure
*	*	*	*		*	*	*		*	Control pressure
		*			*					Throt.-valve assembly/throt. valve
		*								Auxiliary-air device
*		*	*		*					Exhaust-gas recirculation
*	*	*			*					Auxiliary air systems
*	*	*								Idle-speed adjustment
*		*		*				*		Ignition system
*	*	*		*	*	*		*	*	Engine fault

TEST SPECIFICATIONS

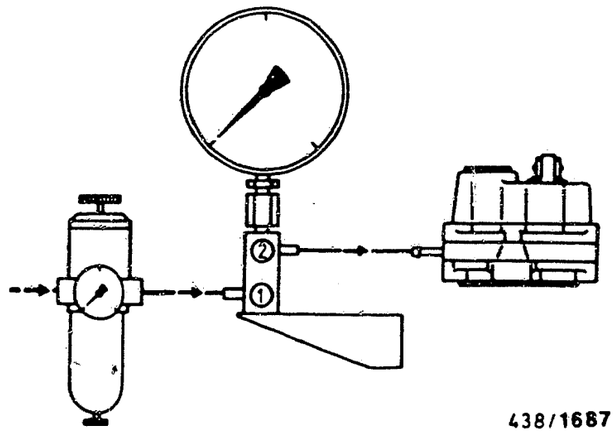
No.	Test/Test condition	Set value
1	Electric fuel pumps Overall delivery of both pumps: Delivery pressure in line between the two pumps: Supply voltage under load (both pumps):	 min. 1500 cm ^{3} /30 s 2...4 bar min. 11.5 V
2	Delivery - control-pressure circuit:	160...240 cm ^{3} /min
3	Fuel distributor - system pressure (all versions): Test specification: Setting:	 6.0...6.7 bar 6.2...6.5 bar
4	Control pressure - tests: Take control pressure set value "cold" from adjacent graphs in accordance with measured ambient temperature. For warm-up regulators which have to be tested "with vacuum": connect vacuum pump to intake-manifold pressure connection of warm-up regulator. Vacuum pump setting: 500...550 mbar. Key to graphs: p = Control pressure (gauge pressure) t = Ambient temperature Part no. of warm-up regulator: 0 438 140 016 (Mod. 75), 0 438 140 022 (Mod. 76/77): Versions for vacuum-controlled full-load enrichment. Test with vacuum as per: 0 438 140 054 (Mod. 78-82): Version for full-load enrichment as a function of charge-air pressure. Test as per: 0 438 140 112 (as of Mod. 83): Version for full-load enrichment as a function of charge-air pressure. Test as per:	 top picture center picture bottom picture







No.	Test/Test condition	Set value
	Control pressure – tests (continued):	
	Control pressure "warm":	
	Model 75 with warm-up regulator 0 438 140 016: Version for vacuum-controlled full-load enrichment. Test partly with engine running (at operating temperature). Engine-speed-dependent control-pressure regulation by way of position of vacuum bore in throttle-valve assembly. This bore must be sealed off in the idle position by the throttle valve.	
	Test specifications: idle speed:	2.7...3.1 bar
	high idle speed (approx. 1800 min $^{-1}$):	3.4...3.8 bar
	engine off:	2.7...3.1 bar
	Model 76/77 with warm-up regulator 0 438 140 022: Version for vacuum-controlled full-load enrichment. Test with engine stopped. For testing "with vacuum", connect vacuum pump to vacuum connection of warm-up regulator.	
	Vacuum pump setting: 500...550 mbar.	
	Test specifications: with vacuum:	3.3...3.7 bar
	without vacuum (atmospheric pressure):	2.6...3.0 bar
	Model 78-82 with warm-up regulator 0 438 140 054 and as of model 83 with warm-up regulator 0 438 140 112: Versions for full-load enrichment as a function of charge-air pressure. For testing "with charge-air pressure", a special test facility is required for pressure application as described on Coordinate 6. Pressure setting at adjusting throttle: Open valve 2, set pressure value (picture) with valve 1.	
	Test specifications: without charge-air pressure:	3.45...3.85 bar
	with charge-air pressure 400...600 mbar gauge:	2.7...3.1 bar



438/1687

TEST SPECIFICATIONS (CONTINUED)

No.	Test/Test condition	Set value	
	Control pressure – tests (continued):		
	Pneumatic leak test on full-load diaphragm (all warm-up-regulator versions):		
	Maximum pressure drop from setting:	100 mbar/15 s	
5	Leak test – overall fuel system:		
	Minimum pressure after 10 minutes:	1.7 bar	
	Minimum pressure after 20 minutes:	1.5 bar	
6	Injection valves – opening pressure:	2.1...3.2 bar	
	Leak test at pressure:	1.9 bar	
	Time within which no droplet may drip off:	25 s	
7	Fuel distributor: delivery reference measurement:	Setting: (cm^3/min)	Max. perm. delivery: (cm^3 min)
	Idle:	6.0	6.8
	Part load	40.0	44.0
	Full load	160.0	176.0
	Minimum delivery with max. sensor-plate deflection:	Maximum indication of measuring instrument	
8	Thermo-time switch – resistance measurement between:	Below + 40° C	Above + 50° C
	Terminal G and ground:	30 ... 40 Ω	55 ... 85 Ω
	Terminal W and ground:	0 Ω	120...160 Ω
	Terminal G and terminal W:	30 ... 40 Ω	55 ... 85 Ω
9	Auxiliary-air device – resistance value:	10...45 Ω	

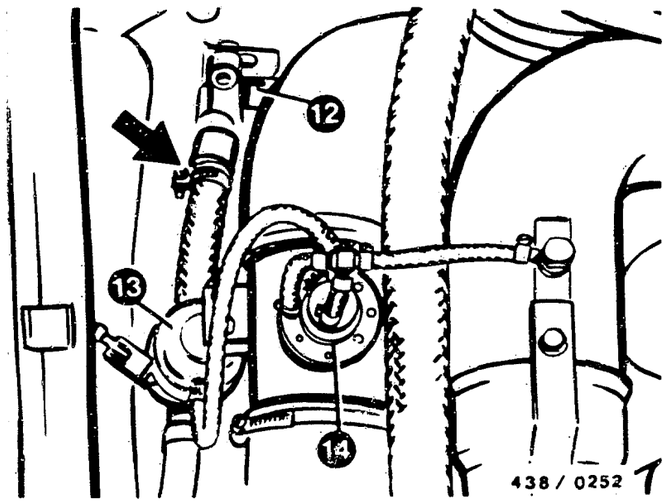
TEST SPECIFICATIONS (CONTINUED)

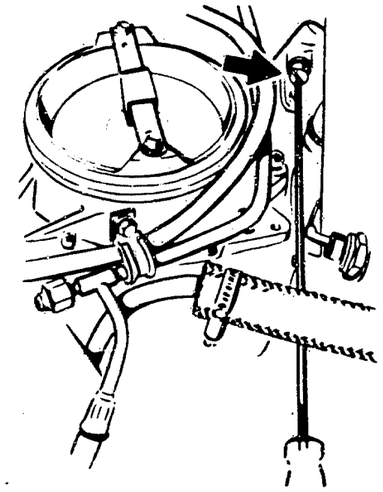
No.	Test/Test condition	Set value
10	Idle-speed adjustment:*	
	Idle speed:	
	Mod. 75-77 General:	900...950 min $^{-1}$
	USA, Japan:	950...1050 min $^{-1}$
	Mod. 78-82 General:	900...1000 min $^{-1}$
	Sweden, USA, California, Japan:	950...1050 min $^{-1}$
	CO values (vol. %):	
	Engine 930/50, Mod. 75/76 Europe:	2.0...2.5 %
	930/51, Mod. 76 USA:	1.0...3.0 %
	930/52, /53, Mod. 77 Gen., USA, California:	2.0...4.0 %
	930/54, Mod. 77 Japan:	1.0...1.5 %
	930/60, Mod. 78-82 General:	2.0...4.0 %
	Sweden:	1.5...2.5 %
	930/61, /63, Mod.78-82 Gen., USA, California:	2.0...3.0 %
	930/62, Mod. 78-82 Japan:	1.5...2.0 %
	930/66, Mod. 83-86 all versions:	1.5...2.5 %
	930/66, as of Mod. 87 all versions:	1.5...2.0 %

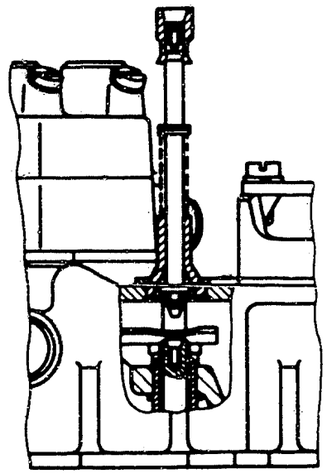
* Special notes on idle-speed adjustment:
  * Engine, ignition and turbo-system/exhaust system O.K.
  * Engine at operating temperature (80...90° C), A/C switched off.
  * Detach hose from secondary air pump to engine and seal it tightly with a suitable plug (arrow, top picture).

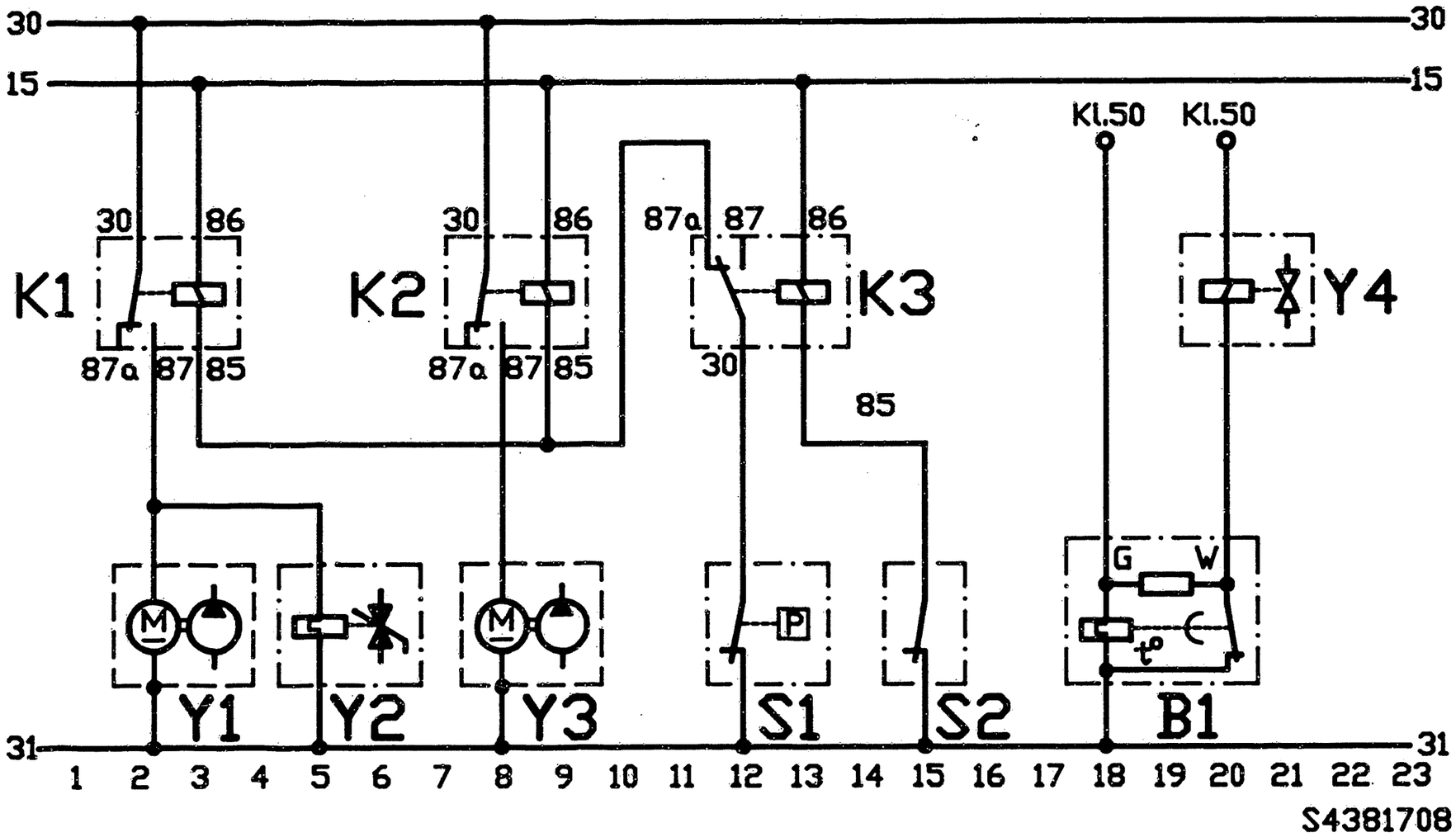
  * Perform adjustment work rapidly to avoid overheating.
  * Bypass screw for adjusting idle speed: see arrow, center picture.
  * Always perform CO adjustment from lean side to rich side, i.e. if adjustment is too rich, first turn idle-mixture-adjusting screw more than necessary in a counter-clockwise direction, then turn it in a clockwise direction as far as setting.
  * CO adjustment for Model 75-77 with air filter removed and using normal adjusting wrench KDEP 1035. Whenever adjustment has been made, seal adjustment bore in air-flow sensor, so as to prevent the ingress of leakage air.

  * As of Model 78, CO testing and adjustment must be performed with the air filter fitted. To do so, press down the pin wrench on the air-flow sensor using the special adjusting wrench (Coordinate 8), so that it is inserted into the idle-mixture-adjusting screw (bottom picture).









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ELECTRICAL DIAGRAM, SAFETY CIRCUIT

B1 = Thermo-time switch
K1 = Actuation relay, electric fuel pump I
K2 = Actuation relay, electric fuel pump II
K3 = Main relay
S1 = Charge-air-pressure switch
S2 = Air-flow-sensor contact
Y1 = Electric fuel pump I
Y2 = Auxiliary-air device
Y3 = Electric fuel pump II
Y4 = Start valve

Notes:

Jumpering of electrical safety circuit:
detach connecter at air-flow sensor.

Relays K1 ... K3 of the safety circuit are located in the central electrics console in the trunk, on the left in the direction of travel, rear relays.

SCHEMATIC REPRESENTATION OF AIR INLET SYSTEM AND EXPLANATORY NOTES ON FUNCTION

Special notes on various components:

Re 3 = Warm-up regulator

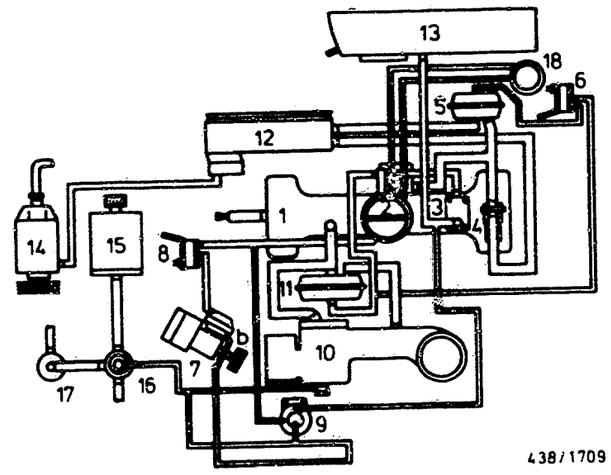
Note: different intake-manifold connections:
Up to Model 77 vacuum connection on top of warm-up regulator.
As of Model 78 charge-air-pressure connection on lower side of warm-up regulator, connection for atmosphere (from air filter) on top.

Re 5 = Auxiliary air valve:

Version with 2 connections for engine versions 930/61 and 930/62 (USA-Federal, Japan): valve is open with engine off and during starting. After starting (as of idle speed) valve closes due to effect of vacuum at decentralized connection.
Version with 3 connections for engine 930/63 (California): The third (thin) connection is connected to the vacuum system via the thermo-valve (6). The auxiliary air valve is initially open even after starting (high idle speed) on account of the vacuum control. As of start initiation, the thermo-valve (6) is electrically heated and closes after a few seconds, i.e. normal idle speed.

Re 8 = Thermo-valve:

The thermo-valve is closed if the engine is off and cold.
After cold starting, this initially interrupts the application of vacuum to the vacuum retard unit at the ignition distributor. Without retardation, the engine runs at a considerably higher idle speed.
As of start initiation (cold start), the thermo-valve is electrically heated and opens after a few seconds (time corresponds to starting temperature). The vacuum connection to the vacuum retard unit is thus established and the ignition is retarded by the specified value.



1 = Air-distributor housing

2 = Throttle-valve assembly

3 = Warm-up regulator

4 = Auxiliary-air device (as of Model 76)

5 = Auxiliary air valve (only as of Model 78 USA, California, Japan)

6 = Thermo-valve (only California Model as of 78, engine 930/63)

7 = Ignition distributor with vacuum advance/retard unit

8 = Thermo-valve (Only California Model as of 78, engine 930/63)

SCHEMATIC REPRESENTATION OF AIR INLET SYSTEM AND
EXPLANATORY NOTES ON FUNCTION (CONTINUED)

Special notes on various components (continued):

Re 9 = Control valve/cutoff valve:

Function as control valve on all European Models with secondary air injection:
Actuation of blow-off switching valve (16) for secondary air injection.
Injection takes place only during induction.
During charging operation, charge-air pressure is applied to the blow-off switching valve (16) via the control valve thus interrupting the injection of secondary air.

Double function as cutoff valve in California Model as of 78, engine 930/63:
1. Function as control valve as described above.
2. Function as actuation valve for vacuum retard unit at ignition distributor. During induction, the ignition is retarded (thermo-valve (8) open) by vacuum at connection "a". During charging operation, the vacuum line is vented in the full-load range. Charge-air pressure acts on the diaphragm of the vacuum retard unit via connection "b" and thus retards the ignition in the full-load range as well.

Re 10 = Charge-air bypass valve for overrun operation.

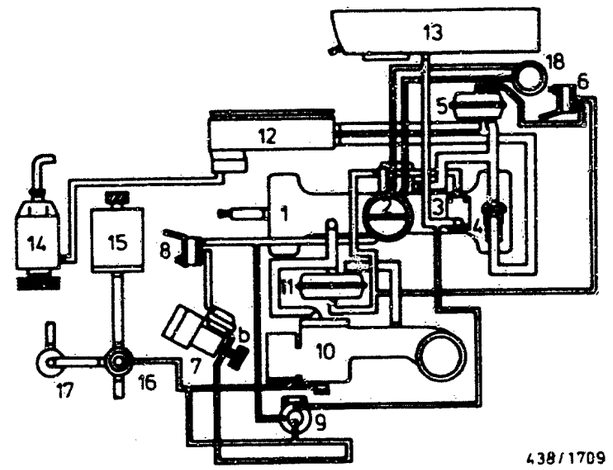
The bypass valve opens as a result of the considerable vacuum during overrun operation. Part of the charge air is passed back to the intake line via the bypass valve. This means that the speed of the turbocharger does not drop off excessively during overrun; when accelerating again, the full engine power is immediately available.

Re 11 = Vacuum limiter:

The vacuum limiter opens during overrun. The engine is thus provided with additional (measured) fresh air to maintain combustion.

Re 14 = Charge-air-pressure regulating valve:

In order to restrict the speed of the turbocharger and thus the charge-air pressure to the prescribed value at full load, the regulating valve opens on reachinng this value. This means that part of the exhaust gas is routed directly to the exhaust system with the turbocharger being bypassed.

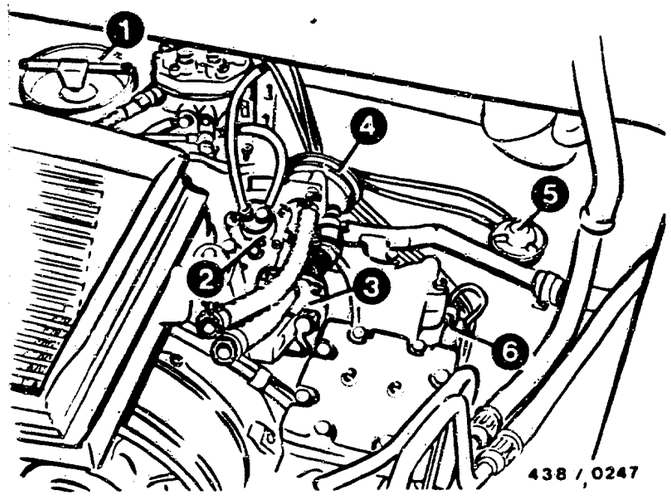


438/1709

9 = Control valve/cutoff valve (European model with secondary air injection or California model as of 78, engine 930/63)

10= Charge-air bypass valve for overrun operation
11= Vacuum limiter
12= Charge-air cooler
13= Air filter system
14= Charge-air-pressure regulating valve
15= Secondary air pump
16= Blow-off switching valve for secondary air pump
17= Non-return valve for air-injection line
18= EGR valve (USA, California, Japan models only)

INSTALLATION POSITION OF COMPONENTS; IMPORTANT ASSEMBLY INSTRUCTIONS



Top picture, air filter removed:

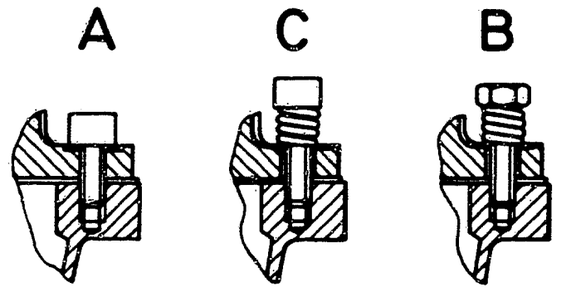
1 = Mixture-control unit
2 = Warm-up regulator
3 = Auxiliary-air device
4 = Auxiliary air valve
5 = EGR valve
6 = Injection valve cyl. 6 (other injection valves not visible in picture)

Removal of the air filter is necessary for performing virtually all work on the K-Jetronic. This presupposes removal of the A/C compressor. To do so, unscrew the three fastening screws, remove the compressor with the connected hoses and have someone hold the compressor whilst removing the air filter. Then set compressor down loosely on bracket.

When installing compressor, set V-belt tension such that it can be easily deflected by 2...3 mm in the center between the two pulleys.

Removal of air filter: unscrew three fastening screws. Detach hose to oil tank at oil tank, detach other hoses at air filter.

Notes on removal and installation of mixture-control unit (center and bottom pictures):



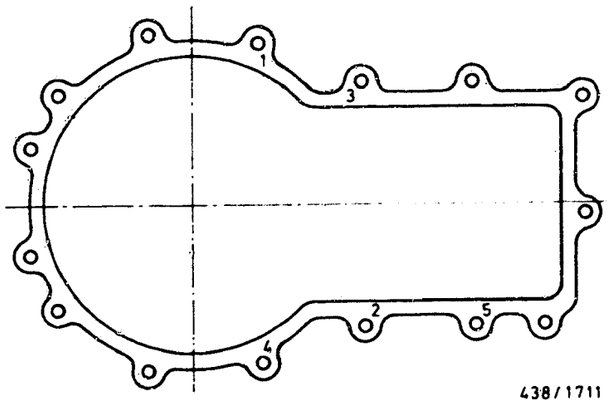
438/1710

Clean and unscrew all fuel lines. Unscrew fastening screws and remove mixture-control unit from bracket.

Always fit new flange seal when installing (Porsche replacement part).
Determination of fastening screws as per center and bottom pictures:

Center picture: A = Screws 1...4
B = Screw 5
C = Other screws

Tighten fillister-head screws 1...4 (without springs) diagonally to 10 Nm. Tighten other fillister-head screws and hexagon screw 5 (5 mm longer) with springs and washers as far as they will go, then slack off by one turn.



438/1711

INSTALLATION POSITION OF COMPONENTS; IMPORTANT ASSEMBLY INSTRUCTIONS (CONTINUED)

Charge-air cooler (as of Model 78):

The charge-air cooler must be removed to provide access to the vacuum limiter, the thermo-valve and the injection valves of the left-hand cylinder bank:

Unscrew the total of 4 fastening screws, detach all hoses and remove charge-air cooler. When re-installing, always use new seals at throttle-valve assembly and air supply pipe.

Fuel supply components:

Electric fuel pump I at front-axle cross-member, electric fuel pump II on underside of vehicle in front of left-hand rear wheel.

Fuel filter -7- and fuel accumulator -8- see top picture.

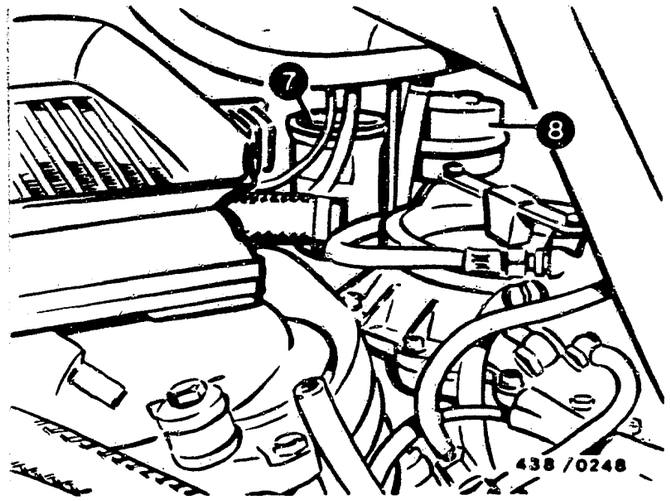
Cold start valve at air distributor (back of engine) beneath throttle-valve-assembly flange.

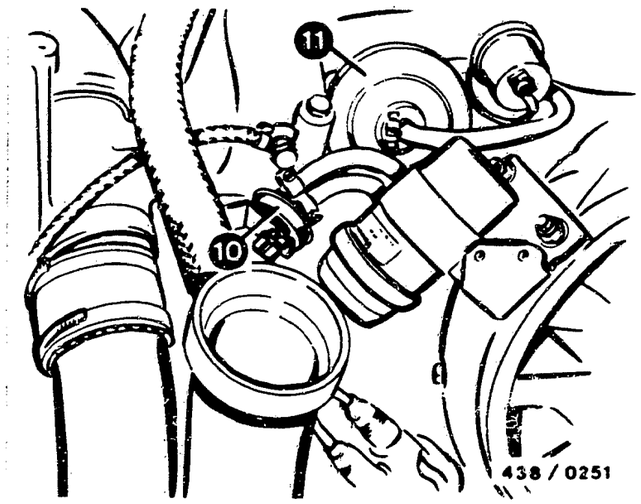
Charge-air-pressure switch on Model 75...77 in air scoop above throttle-valve assembly; as of Model 78 in charge-air cooler, left.

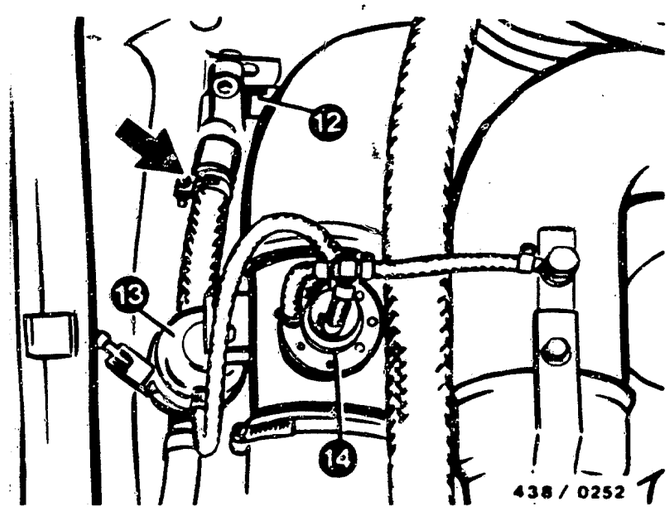
Thermo-valve -10- for ignition-distributor vacuum retard unit and vacuum limiter -11- see center picture.

Secondary air system see bottom picture:

12 = Secondary air pump
13 = Blow-off switching valve
14 = Control valve for secondary air.







Trouble-shooting instructions: POR-5010

BOSCH system : Motronic ML 3.1

Make of vehicle : PORSCHE

Basic microcard : POR-507

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

PORSCHE 944 Turbo (S)
with 2.5 l / 4-cyl. engine 7.85 ->

* Countries: worldwide.

* Motronic system ML 3.1 (35-pole plug).

* These instructions apply to the following control units:
  0 261 200 053 (USA with lambda closed-loop control),
  0 261 200 054 (without lambda closed-loop control),
  0 261 200 075 (standard control unit for vehicles with and without catalytic converter),
  0 261 200 088 (as of 9.87 for Turbo S and as of 9.88 für all 944 Turbo with and without catalytic converter).

* Idle-mixture control

* Altitude correction for USA

* Knock and boost pressure control work in conjunction with Motronic.
  Knock and boost pressure control are described on a separate microcard.

* Tank ventilation with active-carbon container as of approx. model year 1988 only for vehicles with catalytic converter.

* Engine designed for 95 RON.
  91 RON is permitted, however the knock and boost pressure control retards the ignition angle and decreases the boost pressure.
  Power output is thus reduced.

SPECIAL FEATURES (CONTINUED)

* Reference-mark sensor is shielded with metal sleeve in holder, so as to avoid interference. Interference can lead to an incorrect ignition angle and make it impossible to start the engine. The metal sleeve is an absolute necessity in the case of vehicles with a clutch housing which features a recess for the reference-mark sensor instead of a hole.

* Adaptation of country version with encoding plug and adapter plug to term. 10 or term. 30.

Terminals / Country variant	Term. 10	Term. 30
RoW 4) without Cat 3)	open	1.8 k Ω to ground 2)
RoW 4) with Cat	open	open
USA-Federal	open	Altitude capsule
USA-California Japan	to ground 1)	Altitude capsule
Sweden/ Switzerland without Cat	to ground 1)	1.8 k Ω to ground 2)

1) Use encoding plug (Porsche No. 944.612.525.01).
2) Use adapter plug with 1.8 k Ω (Porsche No. 944.612.421.00). There is no adapter plug with 0 261 200 054.
3) In the case of vehicles without lambda sensor, ensure that a cable jumper (Porsche No. 911.612.422.00) is connected to the wiring-harness plug in place of the lambda sensor, so as to avoid interference.
4)RoW = Rest of World (not including USA).

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

Trouble-shooting is described in detail in the trouble-shooting chart in the basic instructions.

NOTE: Even if reference is made to basic instructions, the set values, term. assignments and special features in these veh.-spec. brief instruct. are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

Avoid fuel injection and high-tension flashover when testing compression!
Motronic relay is therefore to be disconnected.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01

Adapter lead: with no catalytic converter 1 684 463 124 / with catalytic converter 1 684 463 128
Note: Lead ...124 can be used as a substitute for catalytic-converter models, however the lambda closed-loop-control function test must additionally be performed (without universal adapter).

Test step	Switch V	Switch Ω	Term.	Testing of components/function	Test instructions/ Test conditions	Set values
1	V	1	8, 5	Engine-speed sensor (Insulation resistance)	Put into neutral, ignition off. Detach control unit and pump fuse No. 34.	greater than 1 M Ω
2	V	2	25, 5	Reference-mark sensor (Insulation resistance)	—	greater than 1 M Ω
3	V	3	8,27	Engine-speed sensor (Winding resistance)	—	600...1600 Ω
4	V	4	25,26	Reference-mark sensor (Winding resistance)	—	600...1600 Ω
5	V	5	13, 5	Temperature sensor (Engine)	Resistance temperature-dependent. (15°C...30°C) : 80°C) :	1450...3300 Ω 280... 360 Ω
6	V	6	22, 5	Temperature sensor (Intake air)	Resistance temperature-dependent: (15°C...30°C) :	1450...3300 Ω
7	V	7	10, 5	Map switching	Depending on country variant term. 10 to ground: or term. 10 open:	less than 10 Ω greater than 1 Ω
8	8 V		29, 5	not applicable	—	—
9	V	9	2, 5	Throttle-valve sensor (Idle contact)	Accelerator pedal not depressed: Depress accelerator pedal somewhat:	less than 10 Ω greater than 1 M Ω
10	V	10	3, 5	Full-load enrichment via knock-control unit. Resistance of knock-control unit.	Resistance is a function of polarity. Positive at right socket: Reversed polarity:	1...9 k Ω greater than 100 k Ω

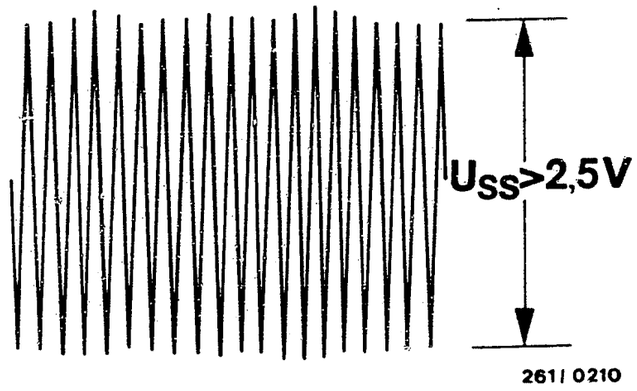
H05 — ⟹

H06 — ⟺

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

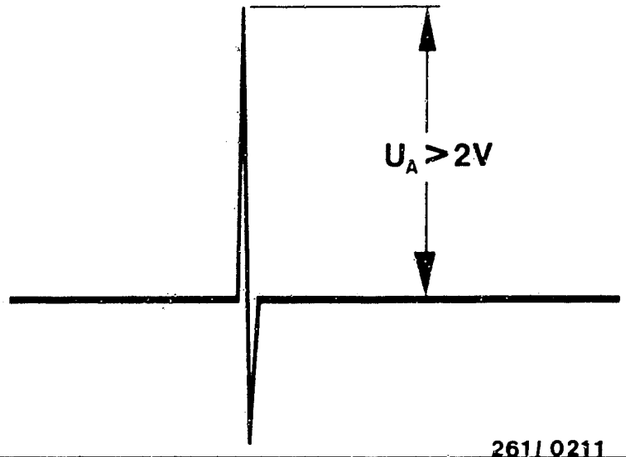
Adapter lead: with no cat. conv. 1 684 463 124 / with cat. conv. 1 684 463 128

Test step	Switch V	Switch Ω	Term.	Testing of component/function Test instructions/conditions	Set values
11	V	11 12 13	16, 5 17, 5 19, 5	Ground leads. Contact resistances :	in each case 10 Ω
12	V	14	30, 5	Resistance at input for altitude corr. Vehicles w/o lambda closed-loop control: Vehicles with lambda closed-loop control or with control unit 0 261 200 054: Vehicles with altitude sensor, switch open (below 1000 m): Vehicles with altitude sensor, switch closed (above 1000 m):	 1,6...2 k Ω greater than 1 M Ω greater than 1 M Ω less than 10 Ω
13	V	15	28, 5	Input for driving-position switch.	less than 10 Ω
14	1	15	8,27	Engine-speed-sensor signal. Test with oscilloscope. Put into neutral and start.	Top picture
15	2	15	25,26	Reference-mark-sensor signal. Test with oscilloscope. Put into neutral and start.	Bottom picture
16	3	14	10, 5	not applicable	
17	4	15	29, 5	A/C switch (if provided). Switch on A/C.	greater than 8 V
18	6	15	35, 5	Main relay. Voltage supply for control unit. Switch on ignition.	10...15 V
19	7	15	18, 5	Main relay. Voltage at term. 18 Switch on ignition.	10...15 V



Engine-speed sensor signal

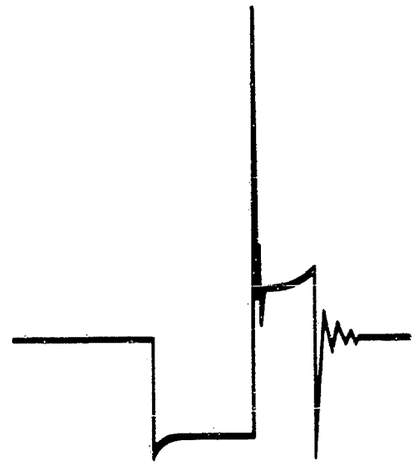
Reference-mark sensor signal



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

Adapter lead: with no cat. conver. 1 684 463 124 / with cat. conver. 1 684 463 128

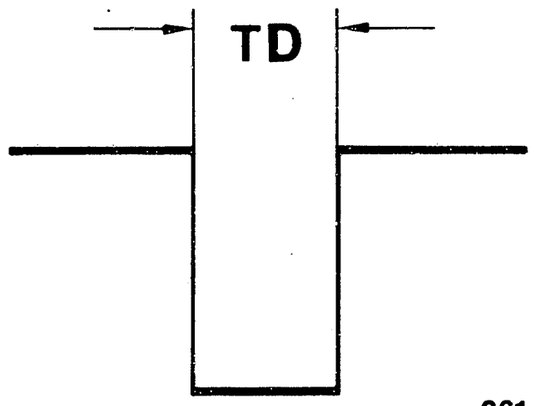
Test step	Switch V	Switch Ω	Term.	Testing of component/function Test instructions/conditions	Set values
20	5	15	1, 5	Switch off ignition and connect control unit. Ignition sign. from ignition coil term.1 Test with oscilloscope. Put into neutral and start.	Top picture
21	8	15	9, 5	Voltage supply for air-flow sensor Switch on ignition.	greater than 4,5 V
22	9	15	7, 5	Air-flow-sensor load signal. Switch on ignition. Sensor flap in off position: Fully deflect sensor flap:	200...300 mV greater than 4,2 V
23	10	15	32, 5	Test dwell-period signal (input) with oscilloscope. Put into neutral and start:	Bottom picture
24	11	15	28, 5	not applicable	
25	12	15	4, 5	Start signal (term. 50). Put into neutral and start.	8...15 V
26	13	15	21, 5	Test dwell-period signal (output) with oscilloscope. Put into neutral and start.	Bottom picture



261/0212

Ignition signal

t_D = Dwell period

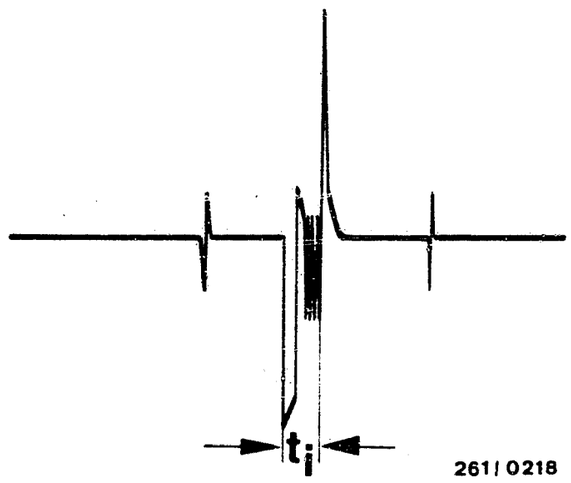


261/331

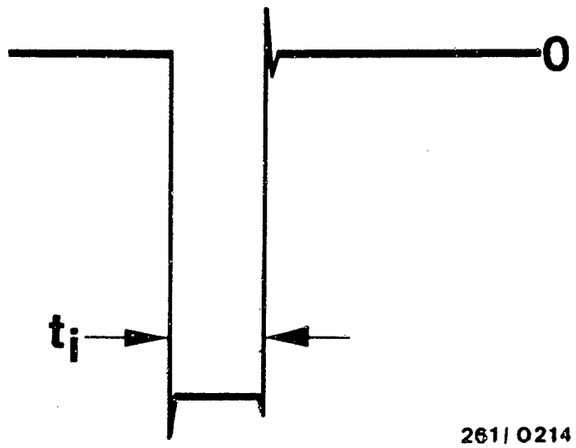
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)

Adapter lead: with no cat. conv. 1 684 463 124 / with cat. conv. 1 684 463 128

Test step	Switch V	Switch Ω	Term.	Testing of component/function Test instructions/conditions	Set values
27	14	15	14, 5	Injection output stage (cyl. 3+4) Test injection signal with oscilloscope. Put into neutral and start.	Top picture
28	15	15	15, 5	Injection output stage (cyl. 1+2) Test injection signal with oscilloscope. Put into neutral and start.	Top picture
29	16	15	11, 5	Measurement output ti. Test injection signal with oscilloscope. Put into neutral and start.	Bottom picture
30	17	15	20, 5	Pump relay. Fit pump fuse. Switch on ignition.	10...15 V
				Pump relay / Pump actuation. Put into neutral and start.	max. 4 V
31	17	15		Fuel pump, pressure regulator. Test fuel pressure: Ignition off, connect pressure gauge to test connection. Ignition on, press button T3.	2,3...2,7 bar

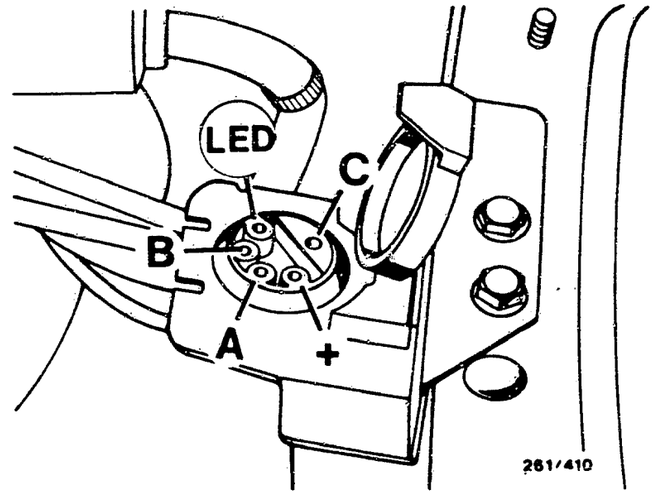


t_i = Duration of injection



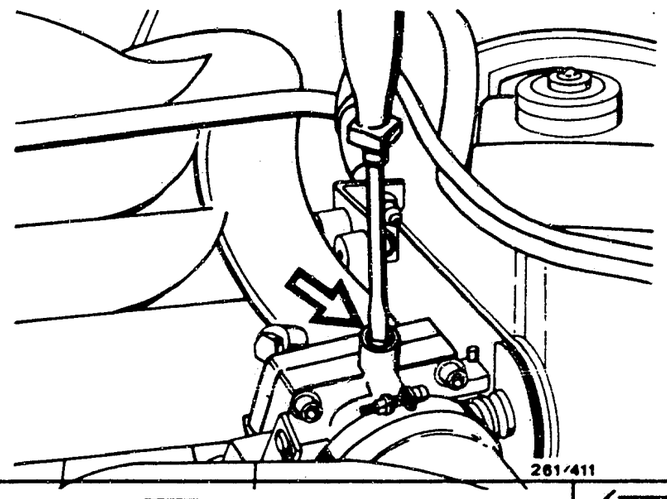
RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)
Adapter lead: with no cat. conv. 1 684 463 124 / with cat. conv. 1 684 463 128

Test step	Switch V	Switch Ω	Term.	Testing of component/function Test instructions/conditions	Set values
32	17	15		Test idle speed and CO: Connect Motortester and exhaust-gas analyzer as well as diagnosis cable (1 684 463 095 or ..158) For vehicles with lambda closed-loop control, connect exhaust-gas analyzer to test connection upstream of cat. conv. (on right-hand side of engine compartm.) For testing with adapter lead 1 684 463 124, detach plug connection of lambda sensor. Perform CO measurement first. Engine temperature approx. 90°C, intake-air temperature approx. +15...30°C, loads switched off. Perform adjustment work rapidly.	Vehicles with no catalytic conv.: 0,5...1,5 vol.%CO Vehicles with catalytic conv.: 0,4...0,8 vol.%CO
				For idle-speed testing and adjustment, connect term. B and term. C with lead at test socket or simultaneously press buttons T5 and T6 and read off test value. Remove lead at test socket or release buttons. Accelerate briefly and test idle speed again.	800...880 min $^{-1}$



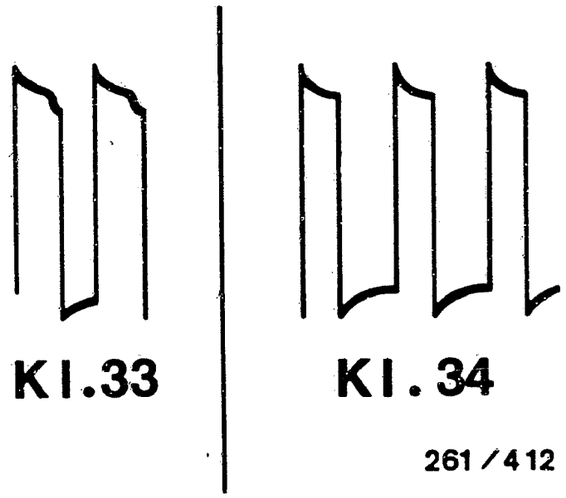
Test jack

Arrow = Adjusting screw for idle speed



RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)
Adapter lead: with no cat. conv. 1 684 463 124 / with cat. conv. 1 684 463 128

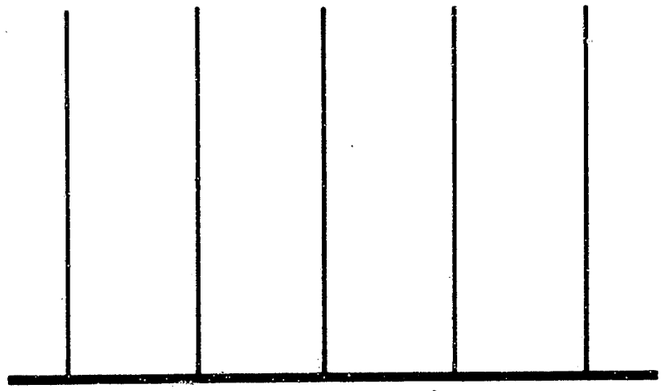
Test step	Switch V	Switch Ω	Term.	Testing of component/function Test instructions/conditions	Set values
33	17	15		Ignition angle at idle speed Engine at operating temperature. Note: Set engine speed precisely, as otherwise incorrect ignition angle is indicated.	0...10 °crankshaft
				Ignition angle at full load Engine at operating temperature. Set engine speed 3000 min $^{-1}$ and press button T6.	8...18 °crankshaft For 0 261 200 088: 10...20 ° crankshaft
34	17	15		not applicable	
35	17	15		Test overrun cutoff. Set engine speed 2000 min $^{-1}$, press button T5. Injection signals cut out and cut in again above idle speed.	Engine "hunts"
36	18	15	33, 5	Idle-actuator signal. Measure with oscilloscope. Run engine at idle speed.	Top picture
37	19	15	34, 5	As test step 36, however measure at second winding of idle actuator.	Top picture
38	20	15	31, 5	Trigger signal for knock-control unit. Run engine at idle speed.	Bottom picture
39	V	10	3, 5	Caution! Voltage measurement at ohm sockets. Full-load function of knock-control unit is tested. Accelerate briefly up to full-load stop.	With engine idling: approx. 5 V After acceleration briefly less than 5 V



261/412

Signals at idle actuator

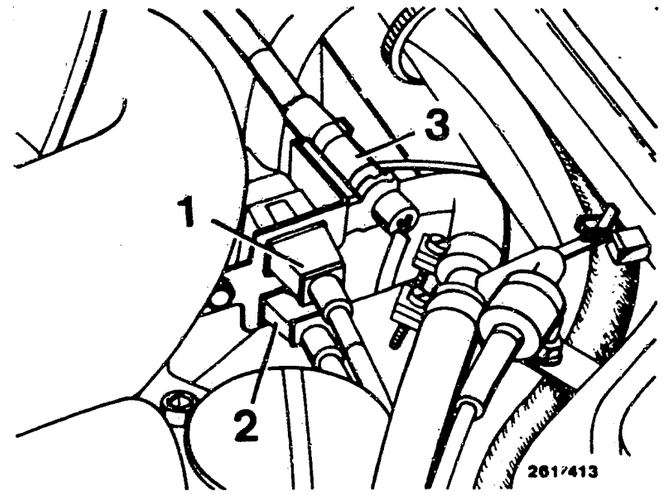
Trigger signal for knock control



261/116

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 (CONTINUED)
Adapter lead: with catalytic converter 1 684 463 128

Test step	Switch V	Switch Ω	Term.	Testing of component/function Test instructions/conditions	Set values
Functional test of lambda closed-loop control only for vehicles with cat. converter Testing of lambda closed-loop control with adapter lead 1 684 463 128. If only the adapter lead 1 684 463 124 is available, the test steps are to be performed without adapter as follows: Disconnect lambda-sensor plug and connect control-unit end of lead (term. 24) to ground (upper closed-loop control limit). To test lower closed-loop control limit, connect end of lead to positive terminal of 1.5 V unicell. Connect negative terminal of unicell to ground. Test closed-loop operation with sensor connected. Refer to test steps 40, 41, 42 for set values.					
40	20	22	24 to ground	Upper lambda closed-loop control limit. Test adapter connects term. 24 to ground. Note: Perform test briefly on account of catalytic converter.	CO increases to in excess of 1,5 vol.%
41	20	23	24 to +2V	Lower lambda closed-loop control limit: Test adapter connects term. 24 to +2V	CO drops below 0,4 vol.% Engine does not run smoothly
42	20	24	24 to lambda sensor	Lambda closed-loop operation Test adapter connects term. 24 to lambda sensor	0,4...0,8 vol.%
				As above, however detach air hose at pressure regulator and seal it. Observe CO value immediately.	CO value increases briefly and drops back to above-mentioned closed-loop control value.



1 = Plug connection for speed sensor
2 = Plug connection for reference-mark sensor
3 = Plug connection for lambda sensor

Pressure regulator
* Fuel pressure: 2,3...2,7 bar

Electric fuel pump
* Fuel delivery (measured in return): at least 350 cm ^{3} /30s
Supply voltage (under load): at least 12 V

Temperature sensor (air)
* Internal electrical resistance measured at air-flow sensor between term. 1 and term. 4 at ambient temperature (+15°C...+30°C): 1450...3300 Ω

Temperature sensor (engine), blue plug.
* Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C): 1450...3300 Ω
with engine at normal operating temperature (approx. + 80° C): 280... 360 Ω

Solenoid-operated injection valve
* Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C): 3,5... 5,5 Ω

Air-flow sensor
* Internal electrical resistance between:
term. 2 (7) and term. 4 (6) : 8...2500 Ω (1)
term. 3 (9) and term. 4 (6) : 500...1100 Ω

(1) Deflect air-flow sensor flap slowly as far as it will go.
Resistance fluctuates between the terminals of the potentiometer.

Engine-speed sensor and reference-mark sensor
* Internal resistance between term.1 and term.2 at ambient temperature (+15°C...+30°C): 600...1600 Ω
* Air gap: 0,8 ±0,5 mm

Throttle-valve sensor
* Resistance of idle contact (term.4 and term.6): approx. 0 Ω
* Refer to knock-control microcard for potentiometer testing.

Idle actuator
* Internal resistance at +15°...+30°C between
term.1 and term.2 : 19...25 Ω
term.3 and term.2 : 17...22,5 Ω

Lambda sensor
* Resistance of heater winding: 1...20 Ω

Ignition coil
* Primary resistance: approx. 0,5 Ω
* Secondary resistance: 5000...7200 Ω

Interference-suppression resistors
* High-tension-distributor rotor: 1 k Ω
* Plug in high-tens.-dist.dome: in each case 1 k Ω
* Spark-plug connector: in each case 3 k Ω

TEST SPECIFICATIONS (CONTINUED)

Altitude sensor
* Contact is closed above
  1000 m: approx. 0 Ω
* Contact is open below
  1000 m: infinity Ω

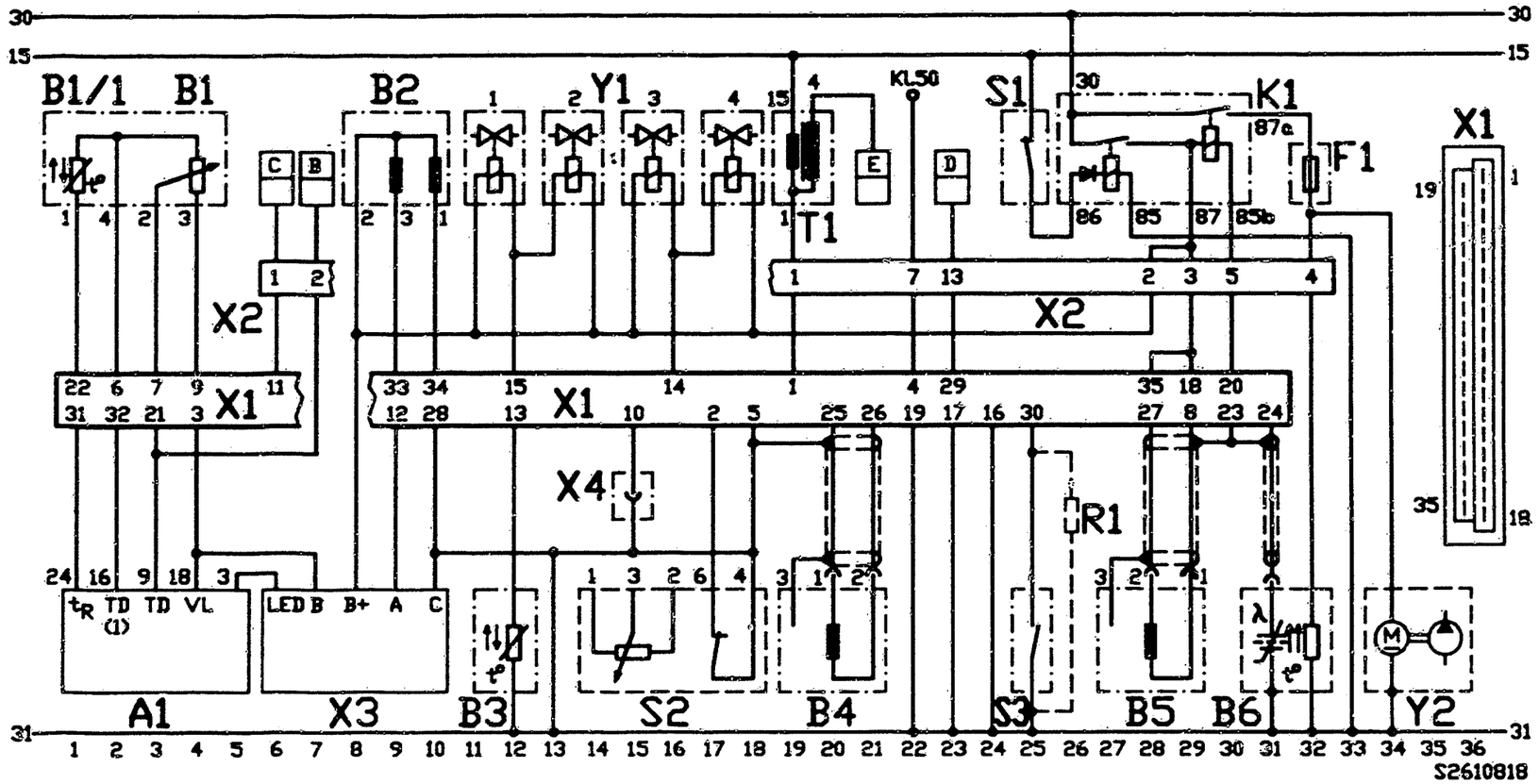
Idle check:
Engine at operating temp.,
switch off loads.
Ambient temperature +15...+30°C
* Idle speed: 820...860 min $^{-1}$
(jumper at test socket
term. B and C)
* Ignition angle: 0... 10 ° crankshaft

CO content:
* with no catalytic converter: 1,0...1,5 vol.%CO
* with catalytic converter: 0,4...0,8 vol.%CO
(measure CO ahead of catalytic
converter, detach lambda-sensor plug).

Perform mixture adjustment at bypass screw in air-flow sensor:
turning in a counter-clockwise direction produces a leaner mixture,
turning in a clockwise direction produces a richer mixture.

Please refer to equipment and Autodata micro-card for settings as regards valve clearance and other engine-related data.

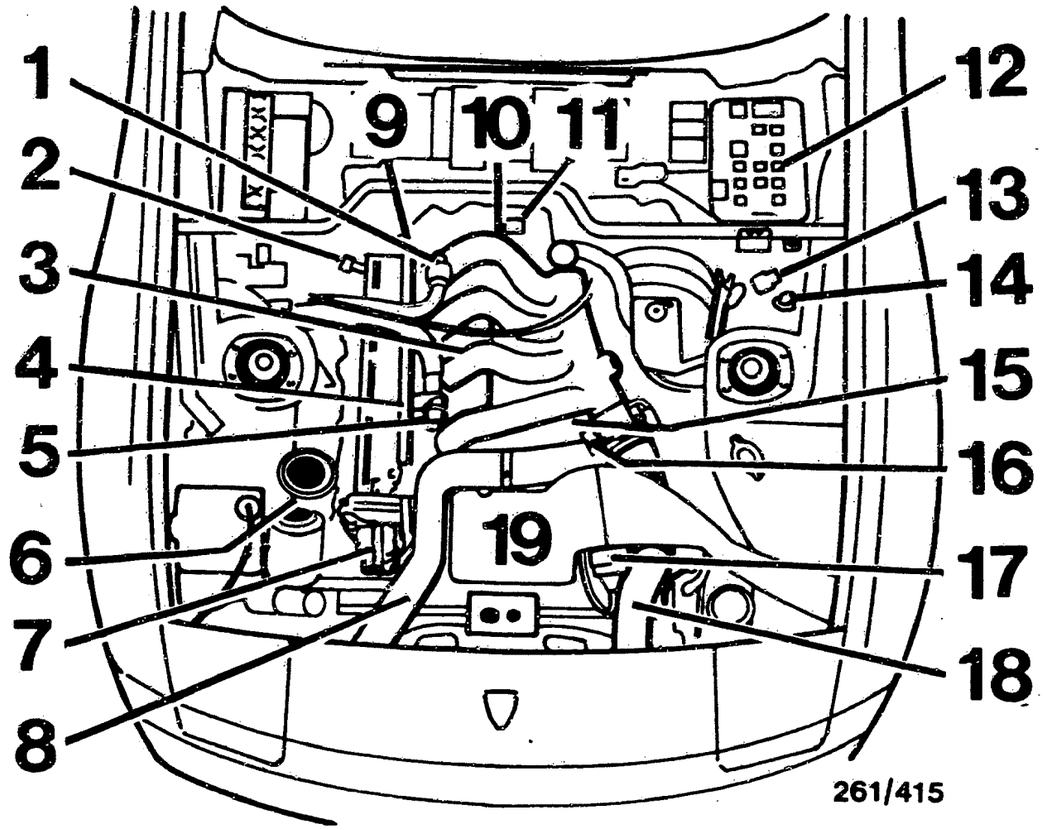
For production reasons:
continued on the following coordinate.



A1 = Control unit for knock control
B = to rev. counter
B1 = Air-flow sensor
B1/1=Temperature sensor (intake air)
B2 = Idle actuator
B3 = Temperature sensor (engine)
B4 = Reference-mark sensor
B5 = Engine-speed sensor
B6 = Lambda sensor (heated)
C = to consumption indicator
D = to A/C (B+)
E = High-tension distributor
F1 = Fuse No. 34 in central-electrics console
K1 = Pump and main relays
(G5 in central-electrics console)

R1 = Resistor 1.8 k Ω (only in vehicles with no lambda closed-loop control)
S1 = Alarm system
S2 = Throttle-valve sensor
(Potentiometer for knock control)
S3 = Altitude sensor (USA only)
TD = Dwell-period signal (output)
TD(1)=Dwell-period signal (input)
t_R = Trigger signal for knock control
T1 = Ignition coil
VL = Full-load signal
X1 = Motronic control-unit plug
X2 = Plug connection in engine comp.
X3 = Test socket
X4 = Map plug connected for California (USA) and S/CH without catalytic converter
Y1 = Injection valves (cyl. 1,2,3,4)
Y2 = Fuel pump

ELECTRICAL TERMINAL DIAGRAM

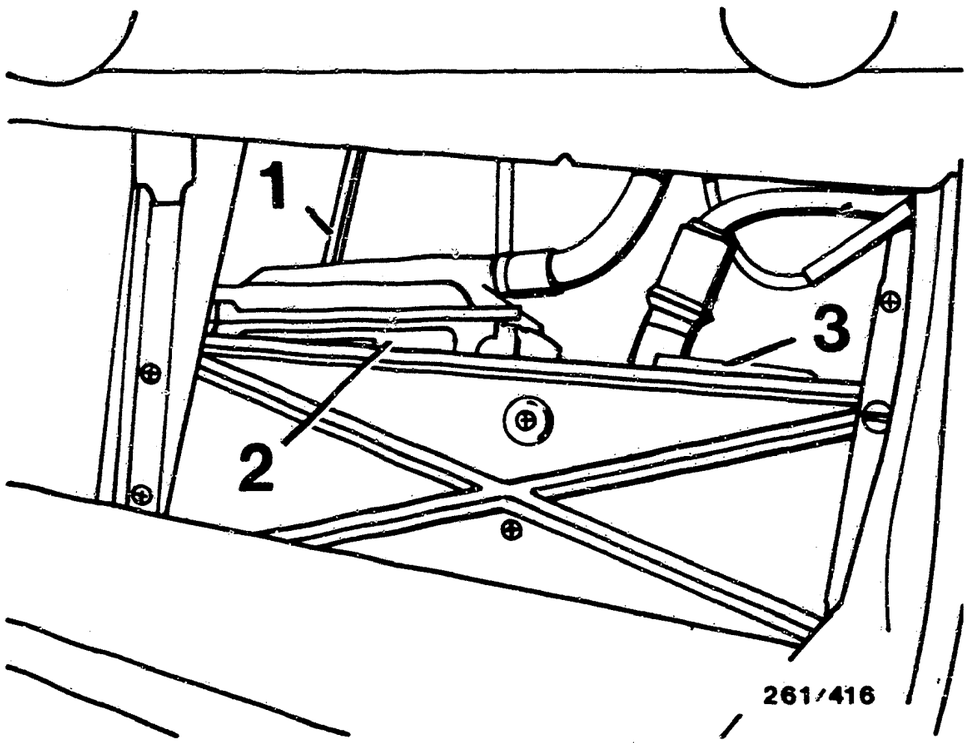


1 = Pressure regulator
2 = Exhaust sampling pipe
3 = Idle actuator
4 = Fuel-distribution pipe with injection valves
5 = Pressure damper
6 = Ingition coil

INSTALLATION POS. OF COMPONENTS

7 = High-tension distributor
8 = Exh.turbo-supercharg.press.pipe
9 = Diagnosis connection
10 = Plug connections for engine-speed and ref.-mark sensor
11 = Plug connection for lambda sensor
12 = Central-electrics console
13 = Test socket

14 = Control valve, tank ventilation
15 = Engine temperature sensor (blue plug)
16 = Throttle-valve sensor
17 = Air-flow sensor
18 = Charge-cooler pressure pipe
19 = Air filter



1 = Vacuum hose to knock-control unit
2 = Motronic control unit (35-pole plug)
3 = Knock-control unit (25-pole plug)

For production reasons:
continued on the following
coordinate.

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Control units:
  On passenger side, behind footwell
  cover.

* Altitude sensor or resistor:
  In the vicinity of the control unit.

* Reference-mark and engine-speed sensor:
  At crankcase flange beneath oil
  filler neck.

* Central ground:
  At clutch housing, in the vicinity of the
  engine-speed and reference-mark sensors.

Trouble-shooting instructions : ALF-5010

BOSCH system : ABS

Make of vehicle : ALFA ROMEO

Basic microcard : PKW-040

TABLE OF CONTENTS

SPECIAL FEATURES

This microcard contains trouble-shooting instructions, valid at the time of publication, for the following models:

ALFA ROMEO 164 10.1987 ->

* ABS with 4 wheel-speed sensors and 4 hydraulic channels.
* Sensor ring gear with 90 teeth.
* Up to approx. year of manufacture 9.1988 adjust wheel-speed sensors on all wheels as required with shims.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

* For safety reasons, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.
  Exception: relays.
* Do not loosen any screws on the hydraulic modulator! Danger of fatal accident due to brake failure.
* Caution when handling brake fluid. Poisonous!

For further information, see basic instructions.

TEST REQUIREMENTS FOR TESTING WITH
ABS2 LED TESTER

* Regulatory tire size fitted?

* Check for firm seating of ground of return-supply pump.

* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.

* Check for firm seating of ground strap between engine block and vehicle frame.

* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).

* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).

* If the ABS warning lamp lights up constantly and does not go out, check the following points:

- Controller plug sitting correctly on controller and latched?

- All plug contacts O.K.?

- Spring contacts latched?

- Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

  Wheel-speed sensors:
  front left to term. 5 and term. 4.
  front right to term. 23 and term. 21.
  rear left to term. 7 and term. 9.
  rear right to term. 24 and term. 26.
  rear axle to term. - and term. -.

- V-belt snapped?
  (Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).

* Connect ABS 2 LED tester to ABS wiring harness.

- Disconnect and connect controller only with ignition switched off.

- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).

- Observe LED (green) for current supply in all program-selector-switch positions.

C A U T I O N !

Do not drive with tester connected!
The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.
Repeat the complete test program after any repairs are carried out.
The Antiskid System is a vehicle safety system.
Work on the system demands detailed knowledge of the system.
The conventional brake system must be O.K.

General information for trouble-shooting:

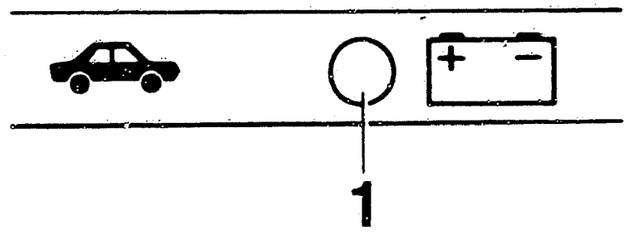
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

RAPID DIAGNOSIS CHART

Do not drive with tester connected! Have all test prerequisites been satisfied?

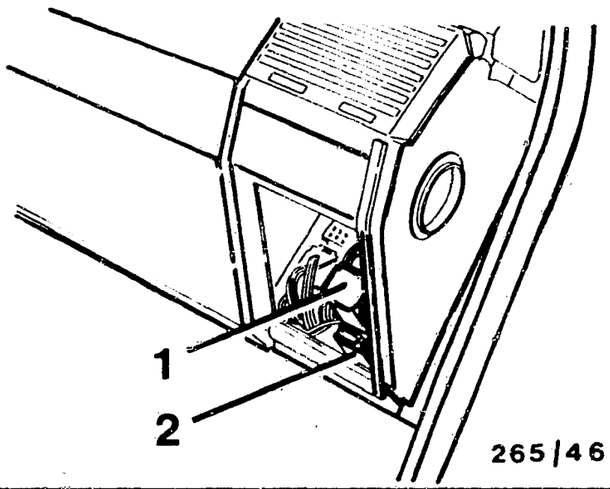
Program-selector-switch settings 1 - 6

Testing of (Measurement at terminals)	Additional operation	Test specification (indication)	Possible causes of fault
Voltage supply (Term.1 and term.20)	Ignition on	LED 1 (top picture) lights up continuously	* Fuse defective. * Inadequate battery charge. * Excessive voltage dips. * Test lead to driving switch, term. 15. * Over-voltage protection relay defective.



265 / 242

1 = Over-voltage protection relay
2 = Fuse 10A

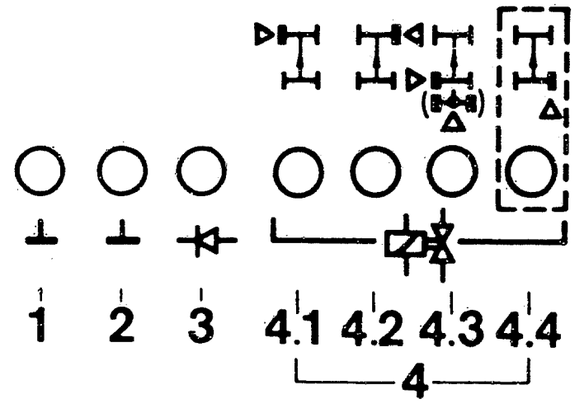


265/469

RAPID DIAGNOSIS CHART (CONTINUED)

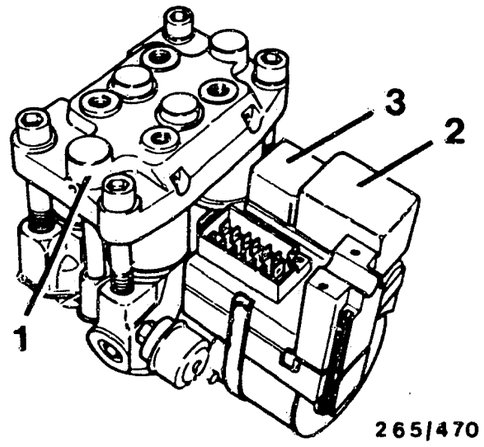
Program-switch position 1 (4-channel hydraulic modulator)

Testing of (measurement at terminals)	Additional operation	Test specification (reading)	Possible causes of faults
Ground connection (term.10, term.34) Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term.2, term.18, term.19, term.35) Off-position and ground connection of relay ABS warning lamp	Ignition on	7 LED (1 to 4.4) simultaneously brightly lit (top picture) ABS warning lamp in vehicle must light up	* LED 1 and/or 2 (top picture) not lit: Check ground terminals for open circuit. * LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay. * One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid-operated valve and leads. Solenoid-operated valve internal resistance 0,7...1,7 Ω * All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective. * Dimmer lighting-up of an LED means contact resistance in the corresponding circuit. * ABS warning lamp not lit: Warning lamp defective. Note: all other 6 LEDs lit.



265/243

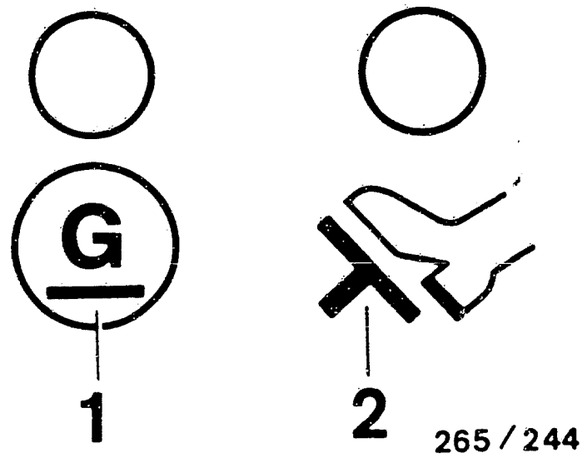
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



265/470

RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 2



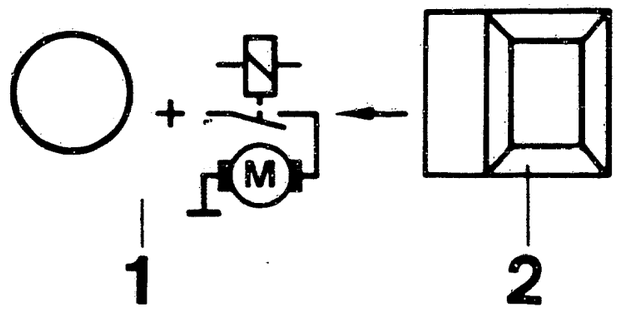
265/244

Under test (Measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Alternator voltage from term. 61/D+ (term. 15)	Ignition on	LED 1 (top picture) lit.	* In some cases, LED does not go out until after burst of throttle (test is O.K. in this case).
	Start engine	LED 1 (top picture) goes out when engine running	* Test lead and signal from alternator term. 61 * Alternator defective.
Stop-lamp switch (term.25)	Ignition on	LED 2 (top picture) lit	* Stop-lamp switch defective. * Check lead to stop-lamp switch.
	Press brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to to stop-lamp switch.

RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 3

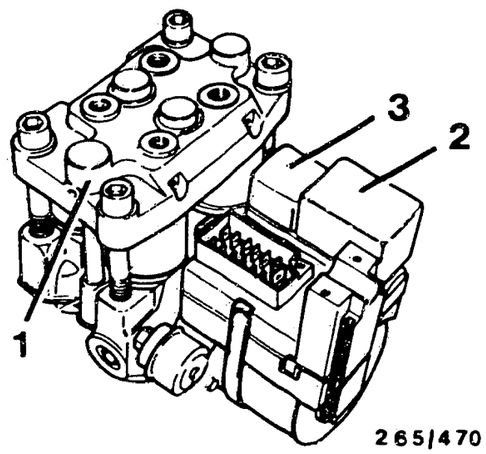
Under test (measurement at the terminals)	Additional operation	Test specifications (reading)	Possible causes of trouble
Motor relay, pump motor in hydraulic modulator (term.14 and term.28)	Ignition on, constantly press push-button 2 (upper illustration)	LED 1 lights up, pump motor runs. After releasing push-button, LED stays lit due to run-on of motor (upper illustration).	* Motor relay defective * Check frame connection and positive terminal of pump motor * Check following leads: from controller term. 14 and term. 28 to hydraulic modulator term. 9 or term. 11. Positive lead to hydraulic modulator term. 2. * Pump motor or hydraulic modulator defective.



265/245

Program-selector-switch position 4 not applicable.

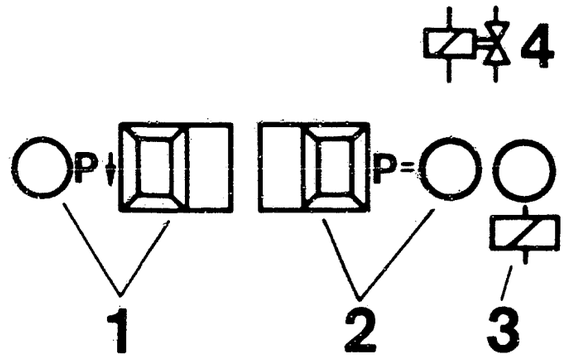
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



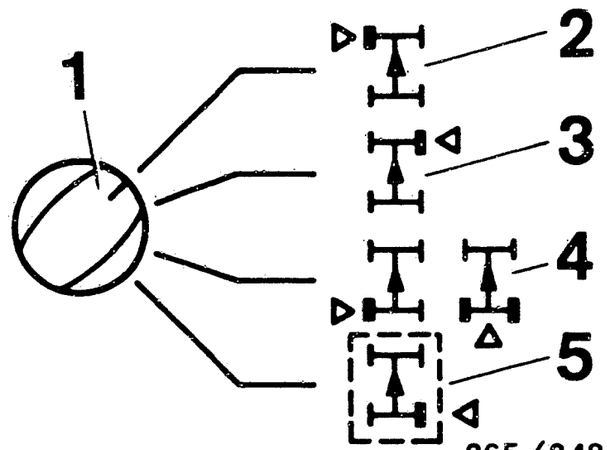
265/470

RAPID DIAGNOSIS CHART (CONTINUED)
Program-selector-switch position 5 (4-channel hydraulic modulator)

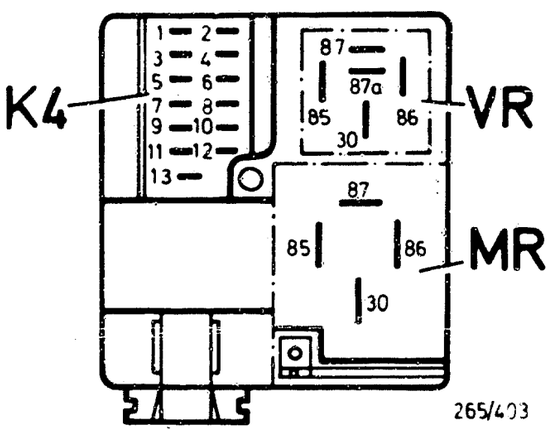
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Valve relay operation (term. 27)	Ignition on	LED 3 (upper illustration) lights up	*Valve relay (winding) or leads defective
Solenoid-operated valves in hydraulic modulator for operation and and mix-up. NOTE: Check each wheel separately in turn. Keep to operating sequence.	Chock up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. Set switch 1 for wheel selection to wheel to be tested (center illustration).		* Repeat test with engine running * Valve relay (make contact) defective * Break in lead from valve relay term. 87 to B+ * Brake leads at hydraulic modulator mixed up
Operation, pressure holding	1. Constantly press push-but. P = (upper illustration)	LED P= (upper illustration lights up)	* Current value not obtained (LED P arrow or P= goes out; upper illustration): battery insufficiently charged. Repeat check with engine running.
	2. Constantly press brake pedal	Wheel turnable by hand	
	3. Release push-button P = (upper illustration)	LED P= goes out (upper illustration) Wheel locks	
Operation, pressure reduction	4. Press push-button P arrow (upper illustration)	LED P arrow (upper illustration) lights up, wheel turnable by hand	* Solenoid-operated valves correctly connected electrically? Wheel,front left: term.2 Wheel,front right: term.35 Wheel,rear left: term.18 Wheel,rear right: term.19 Rear axle: term. -
	5. Release push-button P arrow (upper illustration)	LED P arrow (upper illustration) goes out, wheel locks	* Hydraulic modulator defective
	6. Release brake pedal		



265/247



265/248

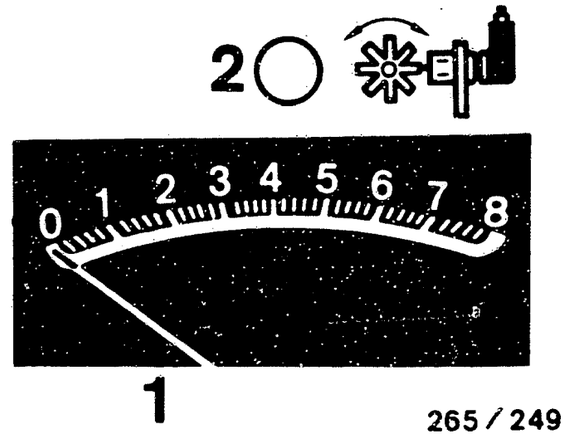


265/403

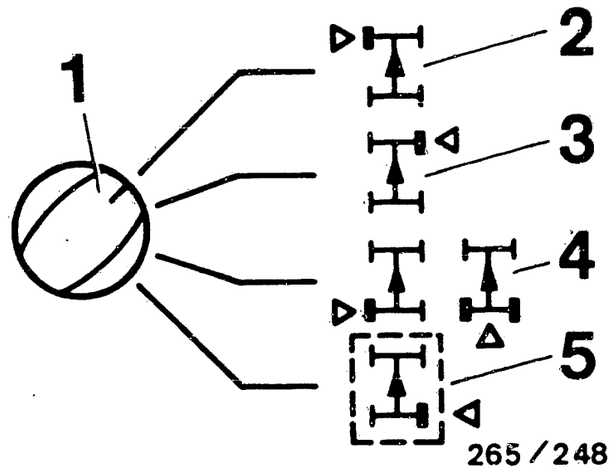
RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Wheel-speed sensor for operation and mix-up NOTE: Check each wheel separately in turn. Wheel, front left: term.4 and term.5 Wheel, front right: term.23 and term.21 Wheel, rear left: term.7 and term.9 Wheel, rear right: term.24 and term.26	Chock-up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. When testing the driven axle, the wheel not being tested must be locked. Set switch for wheel selection to wheel to be tested (lower illustration) Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)	1. Smallest reading larger 1,0 <u>divisions</u> 2. Permissible fluctuation max. 25 % of largest reading.	*Wheel-speed-sensor lead mixed up *Brake in wheel-speed-sensor lead *Wheel-speed sensor defectove Winding resistance Front axle: 0,6...1,6 k Ω Rear axle: 0,6...1,6 k Ω *Air gap between wheel-speed sensor and ring gear too wide *Ring gear defective (e.g. corroded, dirty) or loose. *Ring gear with incorrect number of teeth installed Front axle: 90 teeth Rear axle: 90 teeth *Wheel-bearing clearance too large *Instrument gives reading, LED 2 does not light up: loose contact in wheel-speed sensor lead.



265/249

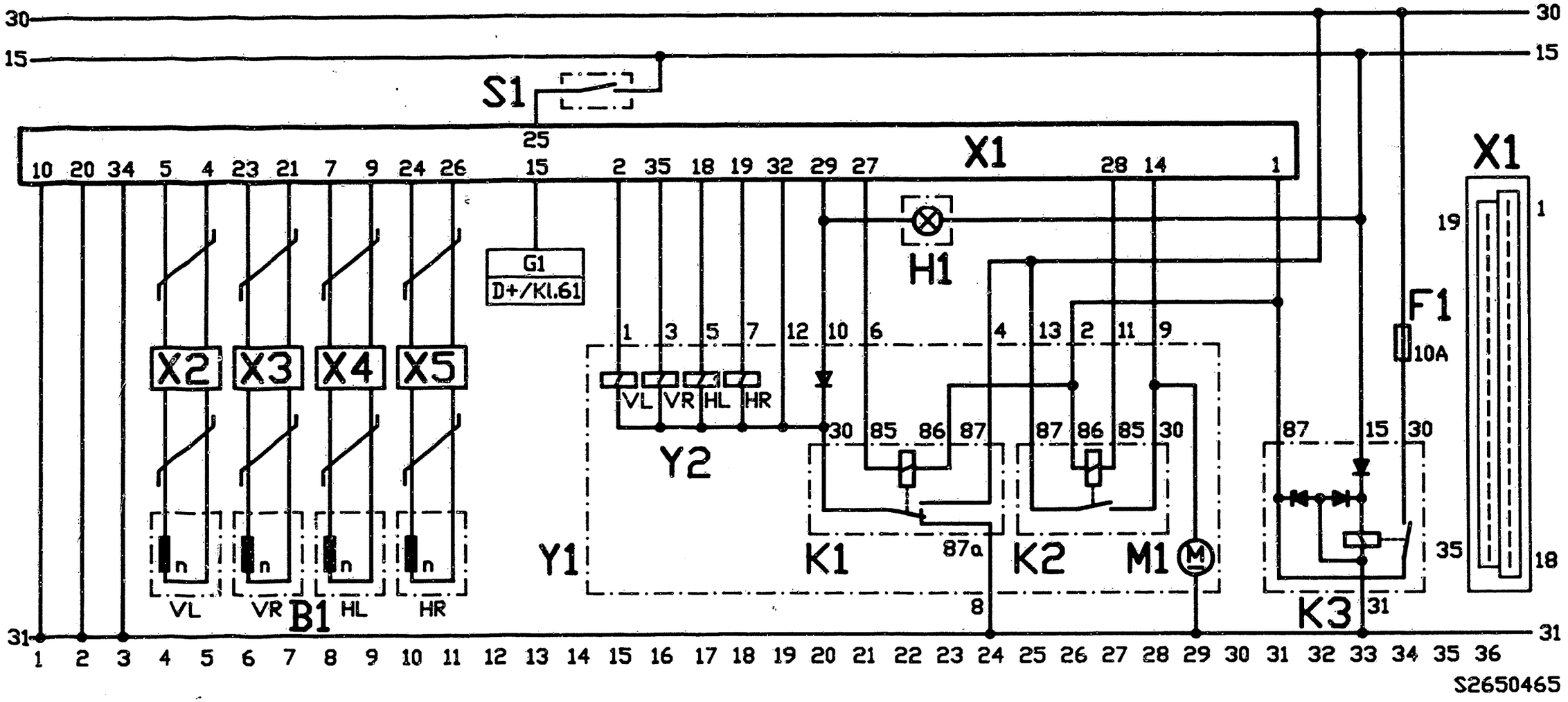


265/248

TEST SPECIFICATIONS

Wheel-speed sensor	
* Winding resistance at ambient temperature (-10°C...+120°C) for	
front wheels:	600...1600 Ω
rear wheels:	600...1600 Ω
Hydraulic-modulator solenoid valves	
* Winding resistance at ambient temperature (-10°C...+120°C):	0,7...1,7 Ω
Air gap between wheel-speed sensor and ring gear	
* at front wheels:	0,8 ±0,5 mm
* at rear wheels:	0,8 ±0,5 mm
Tightening torque for	
* fastening screws of wheel-speed sensors:	> 8 Nm
* Brake-line connections at hydraulic modulator:	12...16 Nm
Number of teeth on ring gears of wheel-speed sensors	
* at front wheels:	90 teeth
* at rear wheels:	90 teeth

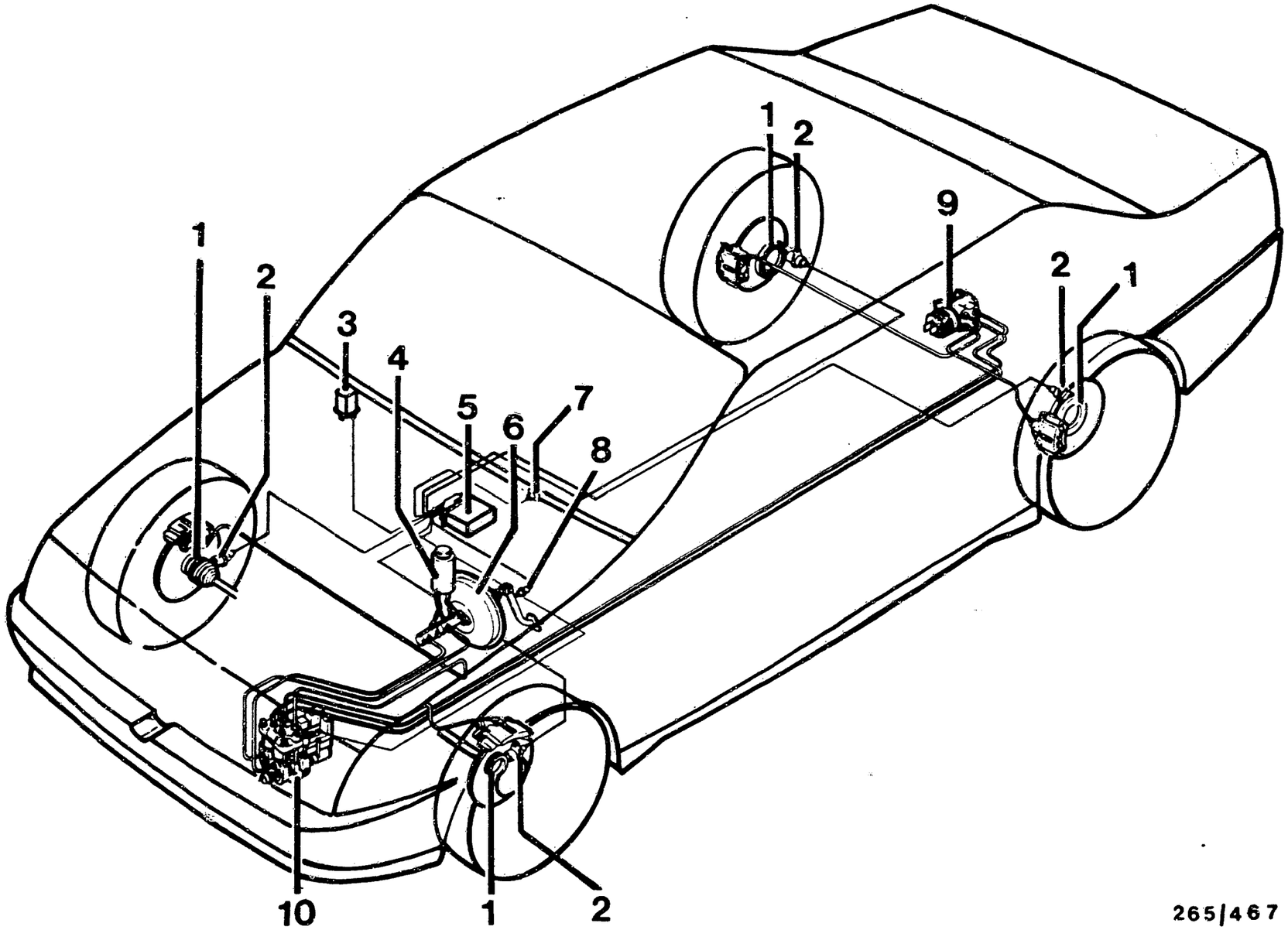
For production reasons:
continued on the following coordinate.



ELECTRICAL TERMINAL DIAGRAM

B1 = Wheel-speed sensor
G1 = To alternator
H1 = ABS warning lamp
K1 = Valve relay
K2 = Motor relay
K3 = Overvoltage-protection relay
M1 = Return-supply-pump motor
S1 = Stop-lamp switch
X1 = Controller plug (35-pin)
X2...X5 = Wheel-speed-sensor plug
Y1 = Hydraulic modulator
Y2 = Solenoid-operated valves
HL = Rear left
HR = Rear right
VL = Front left
VR = Front right

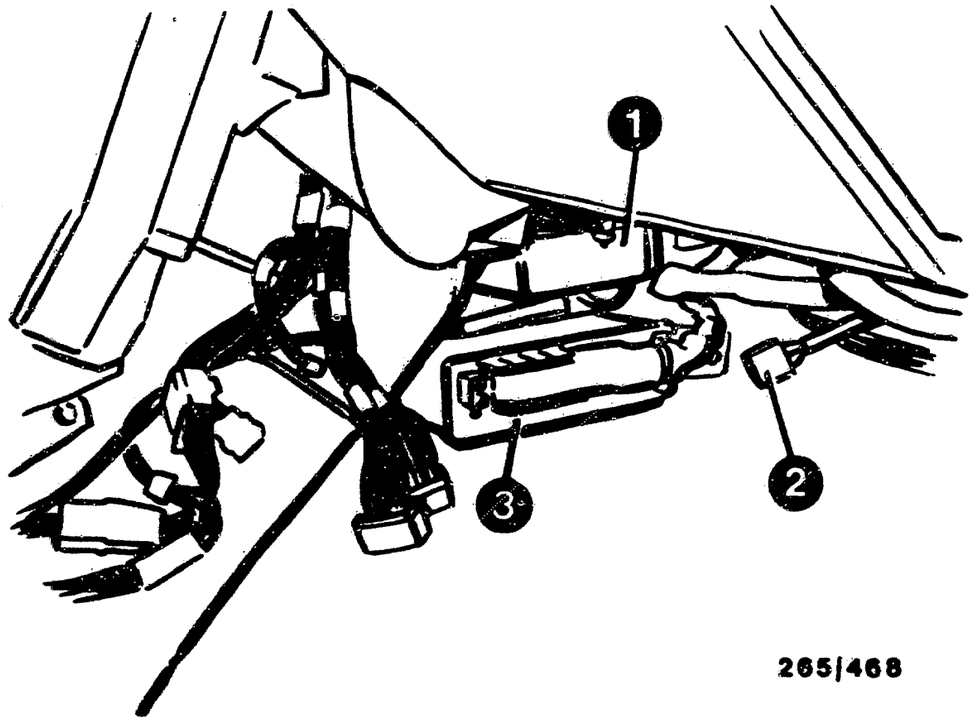
J19 —⟹
J20 ⟸—



265/467

INSTALLATION POSITION OF COMPONENTS

1 = Ring gear
2 = Wheel-speed sensor
3 = Over-voltage protection relay
4 = Brake-fluid reservoir
5 = ABS controller
6 = Brake booster
7 = ABS warning lamp
8 = Stop-lamp switch
9 = Braking-force regulator
10 = ABS hydraulic modulator



265/468

1 = Motronic control unit
3 = ABS controller

INSTALLATION POSITION OF COMPONENTS (continued)

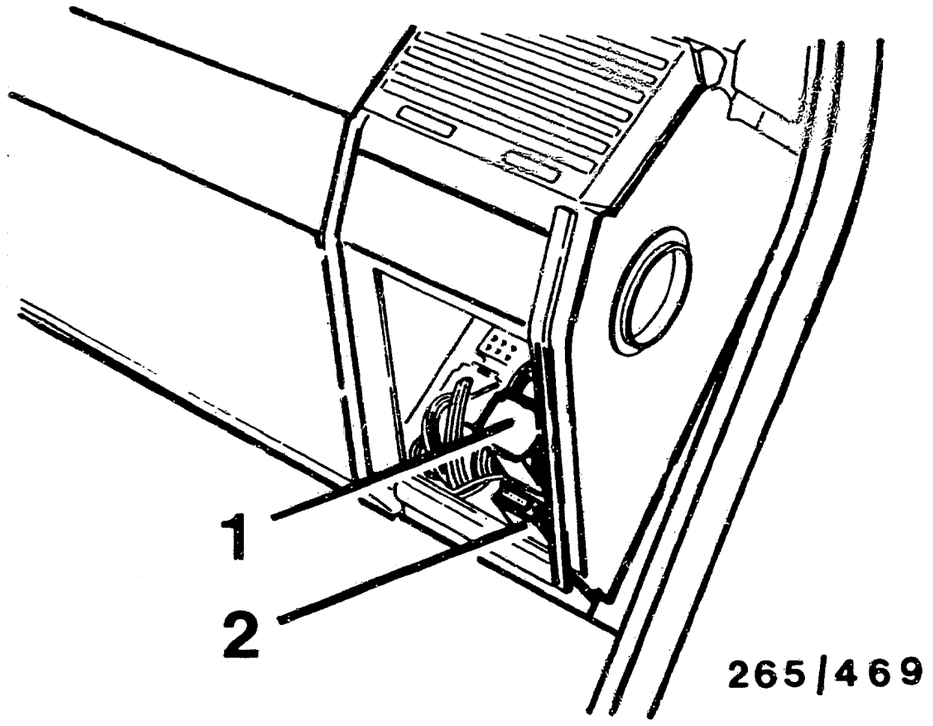
The installation locations always refer to the direction of travel.

* Controller:
  In passenger-side footwell, on left, behind cover for center console.

* ABS warning lamp: in instrument panel.
  Symbol: skidding car.

* Stop-lamp switch:
  At brake pedal.

* Battery:
  On left-hand side of trunk beneath a cover.



265/469

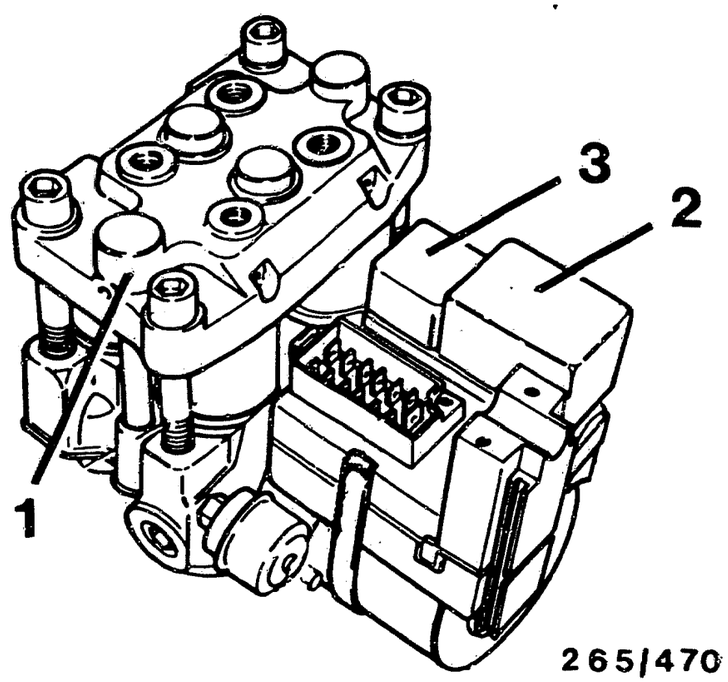
1 = Over-voltage protection relay
2 = Fuse 10 A

INSTALLATION POSITION OF COMPONENTS (continued)

* Over-voltage protection relay:
  In passenger compartment, to right of glove compartment, behind a cover.

* ABS ground terminals:
  At left-hand spring-strut dome and on left of engine.

* Positive terminal (term. 30):
  In engine compartment above the steering column beneath a plastic cover.



265/470

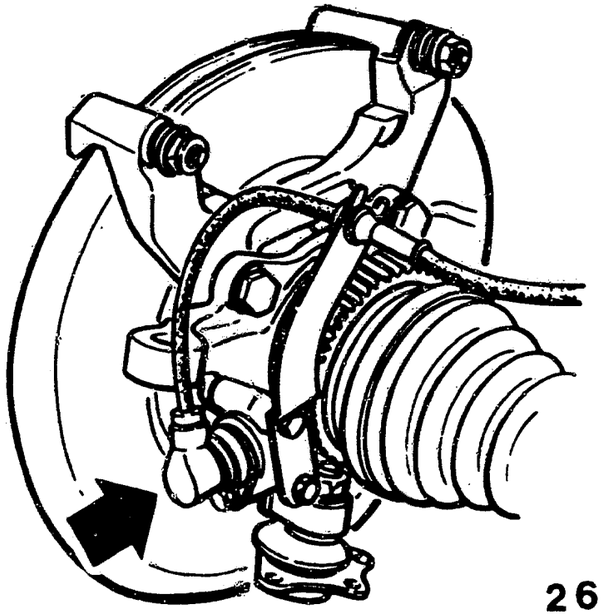
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

INSTALLATION POSITION OF COMPONENTS (continued)

* Hydraulic modulator
  In front left of engine compartment on cross-member.

  The hydraulic modulator cannot be repaired, but rather it is to be replaced in its entirety.
  Exception: changing relay.

  Pay attention to correct assignment of brake-line connections.



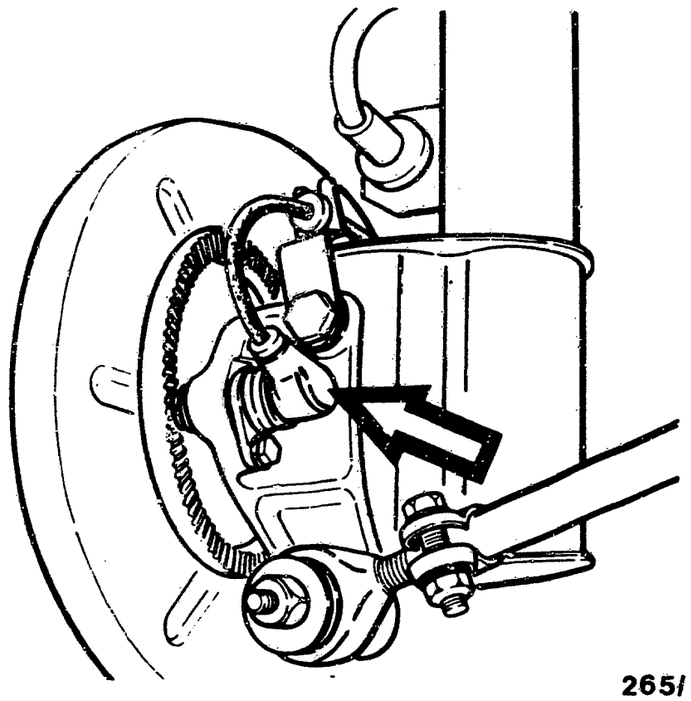
265/471

Arrow = Front wheel-speed sensor

INSTALLATION POSITION OF COMPONENTS (continued)

* Front-axle wheel-speed sensor:
  One each on left and right in steering knuckles.
  Take care not to lose existing shims. Check air gap and correct if necessary with corresponding shims.
  Adjustment using shims is no longer required as of the new axle design from approx. 9.88 onwards.

  Wheel-speed-sensor plug connections:
  On spring-strut domes in engine compartment.



265/464

Arrow = Rear wheel-speed sensor

INSTALLATION POSITION OF COMPONENTS (continued)

* Rear-axle wheel speed sensor:
  One each on left and right at wheels.

  Take care not to lose existing shims. Check air gap and correct if necessary with appropriate shims.
  Adjustment with shims is no longer necessary as of the new axle design from approx. 9.88 onwards.

  Wheel-speed-sensor plug connections:
  On left and right in trunk in recesses beneath the side trim.

For production reasons:
continued on the following coordinate.

Trouble-shooting instructions : ROV-5000

BOSCH system : ABS

Make of vehicle : ROVER

Basic microcard : PKW-040 B1

TABLE OF CONTENTS

SPECIAL FEATURES

This microcard, valid at the time of publication, contains trouble-shooting instructions for the following models:

AUSTIN ROVER
825 Si, Sterling 10.86->
827 Si (L), Sterling 2.88->

* ABS with 4 wheel-speed sensors and 4 hydraulic channels.
* Sensor ring gear with 45 teeth.
* Front-axle wheel-speed sensors attached to intermediate plate.

STRUCTURE, USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

For a detailed description of trouble-shooting, see the basic instructions.

ATTENTION :
The set values, terminal assignments and special features of these vehicle-specific brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

* For safety reasons, the hydraulic modulator must not be repaired, but be exchanged as a complete unit.
  Exception: relays.
* Do not loosen any screws on the hydraulic modulator! Danger of fatal accident due to brake failure.
* Caution when handling brake fluid. Poisonous!

For further information, see basic instructions.

TEST REQUIREMENTS FOR TESTING WITH
ABS2 LED TESTER

* Regulatory tire size fitted?

* Check for firm seating of ground of return-supply pump.

* Check for firm seating and corrosion of ground of overvoltage-protection relay term. 31.

* Check for firm seating of ground strap between engine block and vehicle frame.

* Check for leaks in hydraulic connections at hydraulic modulator and sealing points (visual examination).

* If the ABS warning lamp lights up intermittently when driving (e.g. after switching on loads) and goes out again by itself, check the battery and power supply (alternator, regulator and voltage drops).

* If the ABS warning lamp lights up constantly and does not go out, check the following points:

- Controller plug sitting correctly on controller and latched?

- All plug contacts O.K.?

- Spring contacts latched?

- Check installation position for correct seating of seal ring in controller plug, rounded side downward.

- Check wheel-speed-sensor leads for correct assignment at controller plug:

  Wheel-speed sensors:
  front left to term. 5 and term. 4.
  front right to term. 11 and term. 21.
  rear left to term. 7 and term. 9.
  rear right to term. 24 and term. 26.
  rear axle to term. - and term. -.

- V-belt snapped?
  (Alternator provides no voltage, charge-indicator lamp and ABS warning lamp light up).

* Connect ABS 2 LED tester to ABS wiring harness.

- Disconnect and connect controller only with ignition switched off.

- For testing, switch on ignition in all program-selector-switch positions (tester operates with current supply from vehicle battery).

- Observe LED (green) for current supply in all program-selector-switch positions.

C A U T I O N !

Do not drive with tester connected!
The brake system must be bled of air before the ABS test. Do not activate the ABS tester while the system is being bled.
Repeat the complete test program after any repairs are carried out.
The Antiskid System is a vehicle safety system.
Work on the system demands detailed knowledge of the system.
The conventional brake system must be O.K.

General information for trouble-shooting:

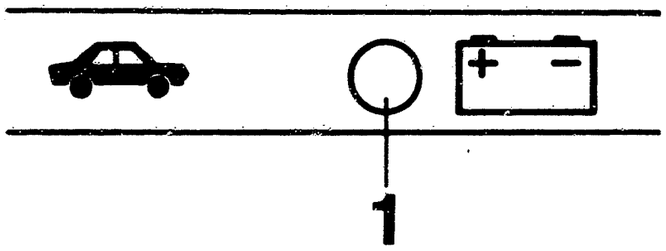
Check all leads for short circuit to ground and contact with positive leads and watch out for worn cable insulation and pinched leads.

RAPID DIAGNOSIS CHART

Do not drive with tester connected. Are all test conditions met?

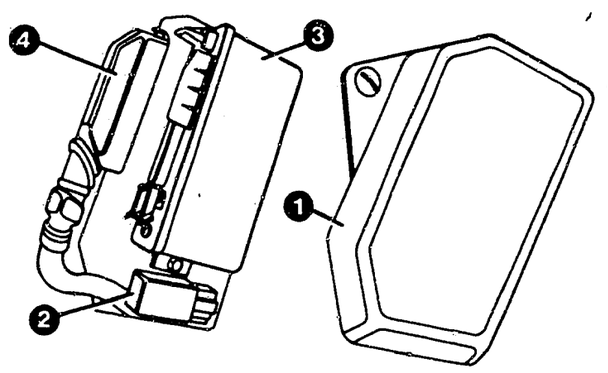
Program-switch positions 1 to 6

Testing of (measurement at terminals)	Additional operation	Test specification (reading)	Possible causes of faults
Power supply (term.1 und term.20)	Ignition on	LED 1 (top picture) continuously lit	*Battery insufficiently charged *High voltage drops *Overvoltage-protection relay defective *Check lead to ignition and starting switch, term. 15



265/242

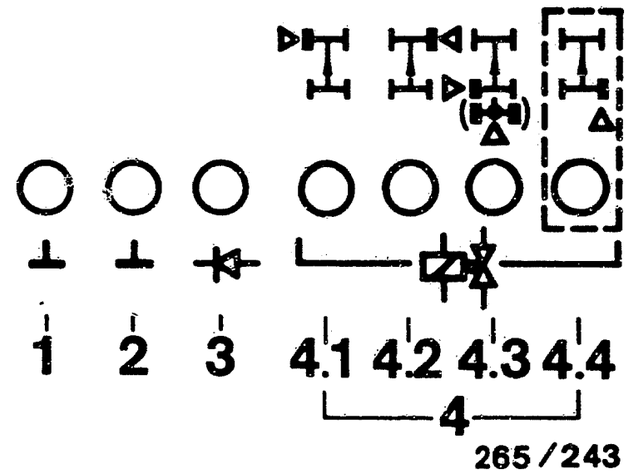
1 = Cover
2 = Over-voltage protection relay
3 = ABS controller
4 = Controller plug



265/473

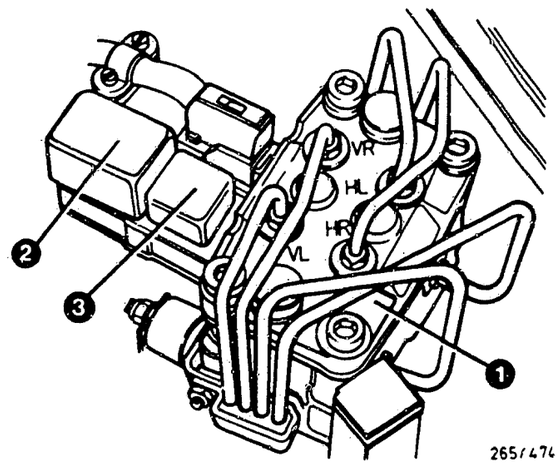
Program-switch position 1 (4-channel hydraulic modulator)

Testing of (measurement at terminals)	Additional operation	Test specification (reading)	Possible causes of faults
Ground connection (term.10, term.34) Diode for warning lamp (term.29, term.32) Solenoid-operated valve internal res. (term.2, term.18, term.19, term.35) Off-position and ground connection of relay ABS warning lamp	Ignition on	7 LED (1 to 4.4) simultaneously brightly lit (top picture) ABS warning lamp in vehicle must light up	* LED 1 and/or 2 (top picture) not lit: Check ground terminals for open circuit. * LED 3 (top picture) not lit: Diode defective, check ground connection of valve relay. * One or more LEDs 4 not lit: Check corresponding plug-in connection for solenoid-operated valve and leads. Solenoid-operated valve internal resistance 0,7...1,7 Ω * All LEDs 4 and LEDs 3 not lit: Check ground connection of valve relay, valve relay defective. * Dimmer lighting-up of an LED means contact resistance in the corresponding circuit. * ABS warning lamp not lit: Warning lamp defective. Note: all other 6 LEDs lit.



265/243

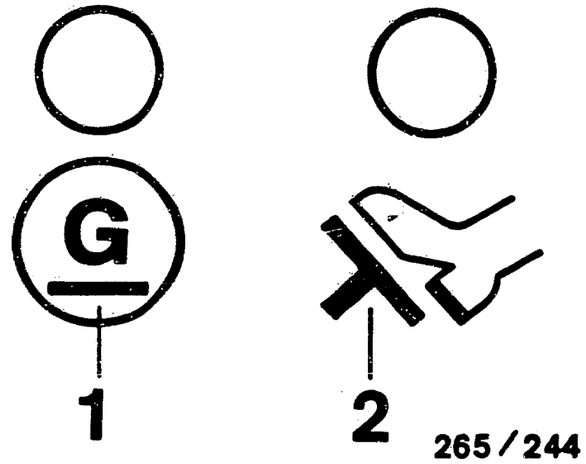
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



265/474

RAPID DIAGNOSIS CHART (CONTINUED)

Program switch setting 2



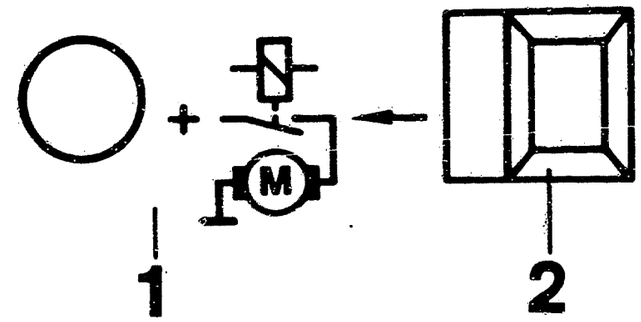
265/244

Testing of (measurement at terminals)	Additional operation	Test specification (indication)	Possible causes of fault
Alternator voltage of term.61 (term.15)	Ignition on	LED 1 (top picture) lights up.	* LED sometimes only goes out after accelerating (test is thus O.K.)
	Start engine	LED 1 (top picture) goes out when engine running	* Test lead to alternator term.61 * Alternator defective.
Brake-light switch (term.25)	Ignition on	LED 2 (top picture) lights up	* Brake-light switch defective. * Test lead to brake-light switch.
	Depress brake pedal	LED 2 (top picture) goes out	* Lead incorrectly connected to brake-light switch.

RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 3

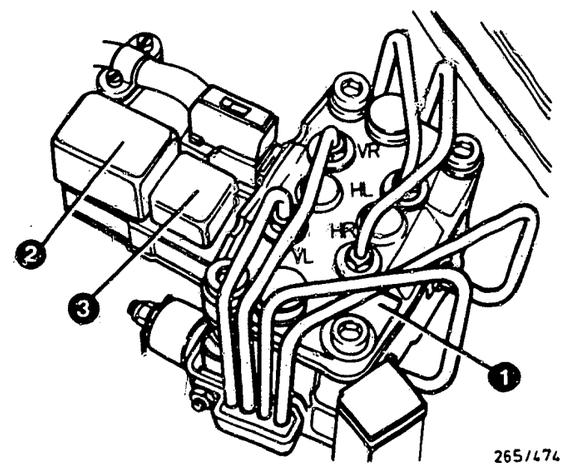
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Motor relay, pump motor in hydraulic modulator (term.14 and term.28)	Ignition on, press button 2 continuously (top picture)	LED 1 lights up, pump motor runs. After releasing button, LED continues to light due to run-on of motor (top picture).	* Motor relay defective * Test ground connection and positive terminal of pump motor * Test following leads: From controller term. 14 and term. 28 to hydraulic modulator term. 9 or term. 11. Positive leads to hydraulic modulator term. 2 and term. 13. * Pump motor or hydraulic modulator defective.



265 / 245

Program-selector-switch position 4 does not apply.

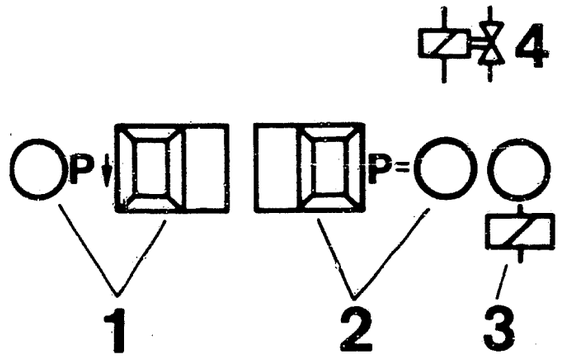
1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay



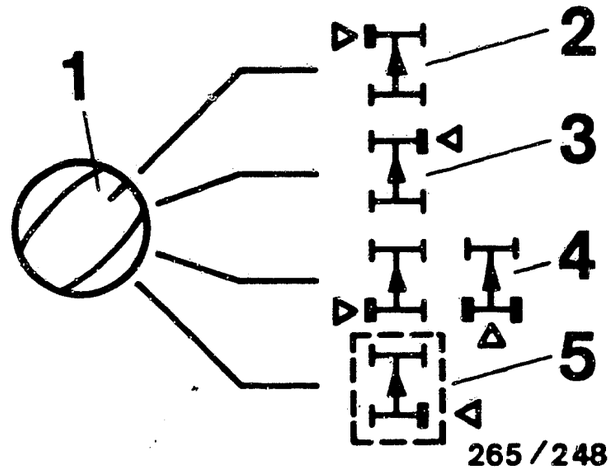
265/474

RAPID DIAGNOSIS CHART (CONTINUED)
Program-selector-switch position 5 (4-channel hydraulic modulator)

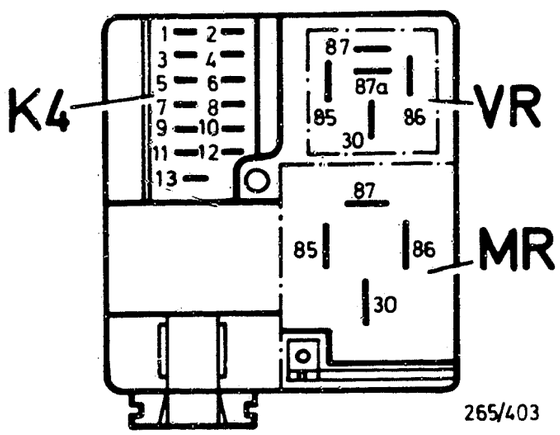
Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Valve relay operation (term. 27)	Ignition on	LED 3 (upper illustration) lights up	*Valve relay (winding) or leads defective
Solenoid-operated valves in hydraulic modulator for operation and and mix-up. NOTE: Check each wheel separately in turn. Keep to operating sequence.	Chock up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. Set switch 1 for wheel selection to wheel to be tested (center illustration).		* Repeat test with engine running * Valve relay (make contact) defective * Break in lead from valve relay term. 87 to B+ * Brake leads at hydraulic modulator mixed up
Operation, pressure holding	1. Constantly press push-but. P = (upper illustration)	LED P= (upper illustration lights up)	* Current value not obtained (LED P arrow or P= goes out; upper illustration): battery insufficiently charged. Repeat check with engine running.
	2. Constantly press brake pedal	Wheel turnable by hand	
	3. Release push-button P = (upper illustration)	LED P= goes out (upper illustration) Wheel locks	
Operation, pressure reduction	4. Press push-button P arrow (upper illustration)	LED P arrow (upper illustration) lights up, wheel turnable by hand	* Solenoid-operated valves correctly connected electrically? Wheel,front left: term.2 Wheel,front right: term.35 Wheel,rear left: term.18 Wheel,rear right: term.19 Rear axle: term. -
	5.Release push-button P arrow (upper illustration)	LED P arrow (upper illustration) goes out, wheel locks	* Hydraulic modulator defective
	6.Release brake pedal		



265/247



265/248

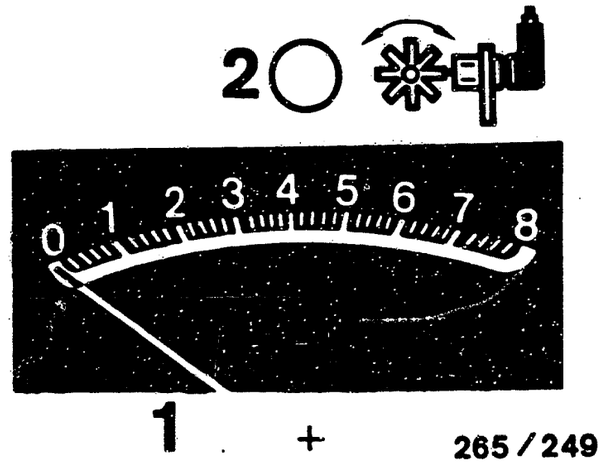


265/403

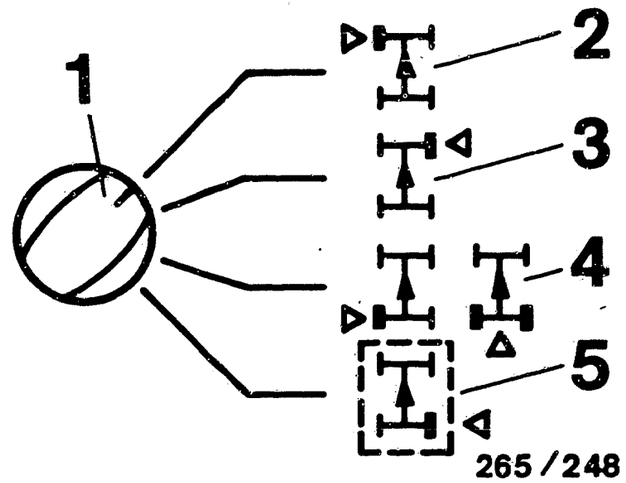
RAPID DIAGNOSIS CHART (CONTINUED)

Program-selector-switch position 6 (4 wheel-speed sensors)

Under test (measurement at the terminals)	Additional operation	Test specification (reading)	Possible causes of trouble
Wheel-speed sensor for operation and mix-up NOTE: Check each wheel separately in turn. Wheel, front left: term4 and term.5 Wheel, front right: term.11 and term.21 Wheel, rear left: term.7 and term.9 Wheel, rear right: term.24 and term.26	Chock-up vehicle. Ignition on. The wheel being tested must be freely turnable by hand. When testing the driven axle, the wheel not being tested must be locked. Set switch for wheel selection to wheel to be tested (lower illustration) Turn wheel by hand until LED 2 above instrument lights up without flickering. (Wheel speed approx. 1 revolution per second). Afterwards, read off indication at instrument: (upper illustration)	1. Smallest reading larger 1,6 <u>divisions</u> 2. Permissible fluctuation max. 25 % of largest reading.	*Wheel-speed-sensor lead mixed up *Brake in wheel-speed-sensor lead *Wheel-speed sensor defectove Winding resistance Front axle: 0,6...1,6 k Ω Rear axle: 0,6...1,6 k Ω *Air gap between wheel-speed sensor and ring gear too wide *Ring gear defective (e.g. corroded, dirty) or loose. *Ring gear with incorrect number of teeth installed Front axle: 45 teeth Rear axle: 45 teeth *Wheel-bearing clearance too large *Instrument gives reading, LED 2 does not light up: loose contact in wheel-speed sensor lead.



265/249

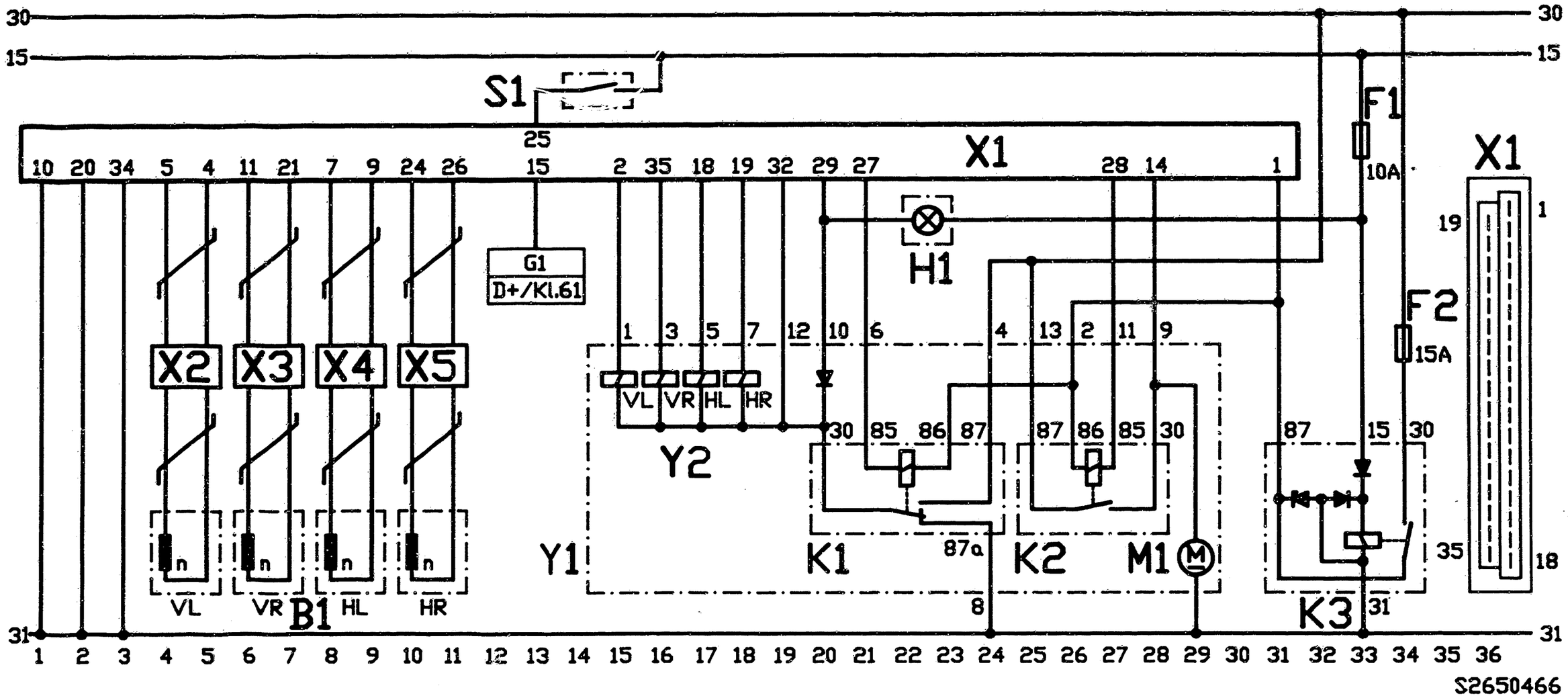


265/248

TEST SPECIFICATIONS

Wheel-speed sensors	
* Winding resistance at ambient temperature (-10°C...+120°C) for	
front wheels:	600...1600 Ω
rear wheels :	600...1600 Ω
Hydraulic-modulator solenoid valves	
* Winding resistance at ambient temperature (-10°C...+120°C):	0,7...1,7 Ω
Air gap between wheel-speed sensor and ring gear	
* at front wheels:	0,3 ...1,025 mm
* at rear wheels :	0,165...1,035 mm
Tightening torque for	
* fastening screws of wheel-speed sensors:	> 8 Nm
* brake-line connections at hydraulic modulator:	12...16 Nm
* fastening screws for wheel-speed-sensor support at front wheels	25 Nm
Number of teeth on wheel-speed-sensor ring gears	
* at front wheels:	45 teeth
* at rear wheels :	45 teeth

For production reasons:
continued on the following coordinate.

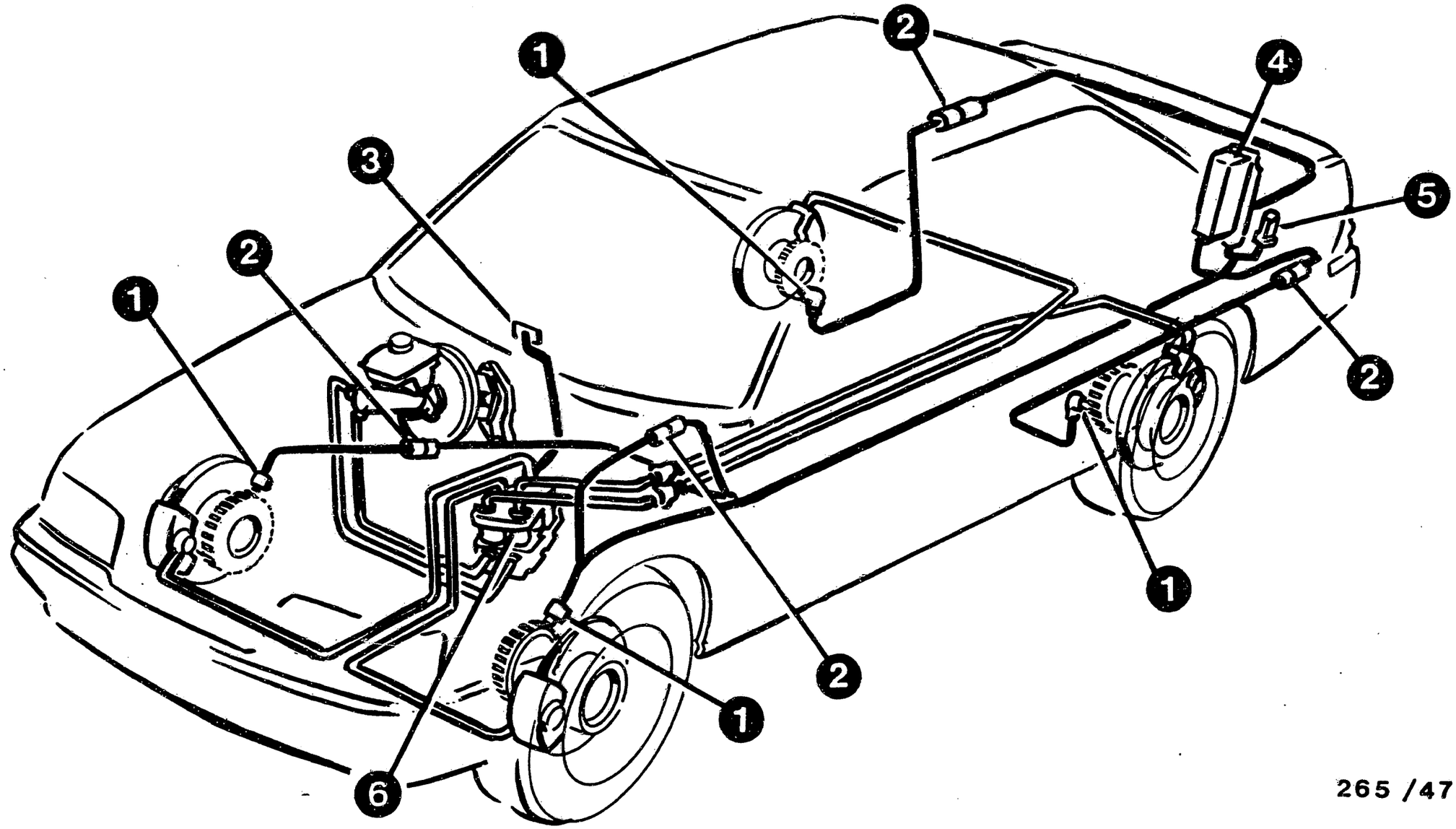


ELECTRICAL TERMINAL DIAGRAM

B1 = Wheel-speed sensor
G1 = To alternator
H1 = ABS warning lamp
K1 = Valve relay
K2 = Motor relay
K3 = Overvoltage-protection relay
M1 = Return-supply-pump motor
S1 = Stop-lamp switch
X1 = Controller plug (35-pin)
X2...X5 = Wheel-speed-sensor plug
Y1 = Hydraulic modulator
Y2 = Solenoid-operated valves
HL = Rear left
HR = Rear right
VL = Front left
VR = Front right

K19 — ⟹

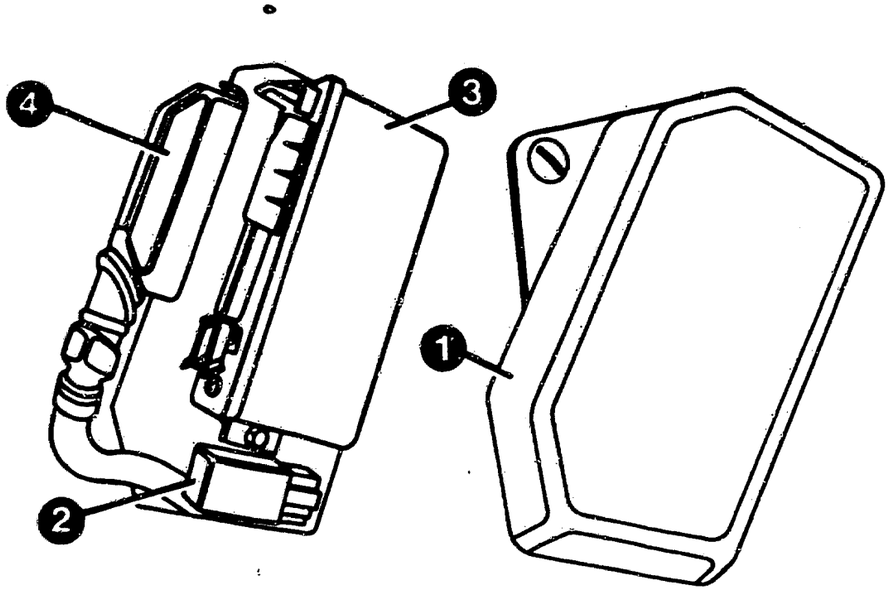
K20 — ⟸



265 /472

1 = Wheel-speed sensor
2 = Wheel-speed-sensor plug connection
3 = ABS warning lamp in instrument panel
4 = ABS controller
5 = Over-voltage protection relay
6 = Hydraulic modulator

INSTALLATION POSITION OF COMPONENTS



265/473

1 = Cover
2 = Over-voltage protection relay
3 = ABS controller
4 = Controller plug

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

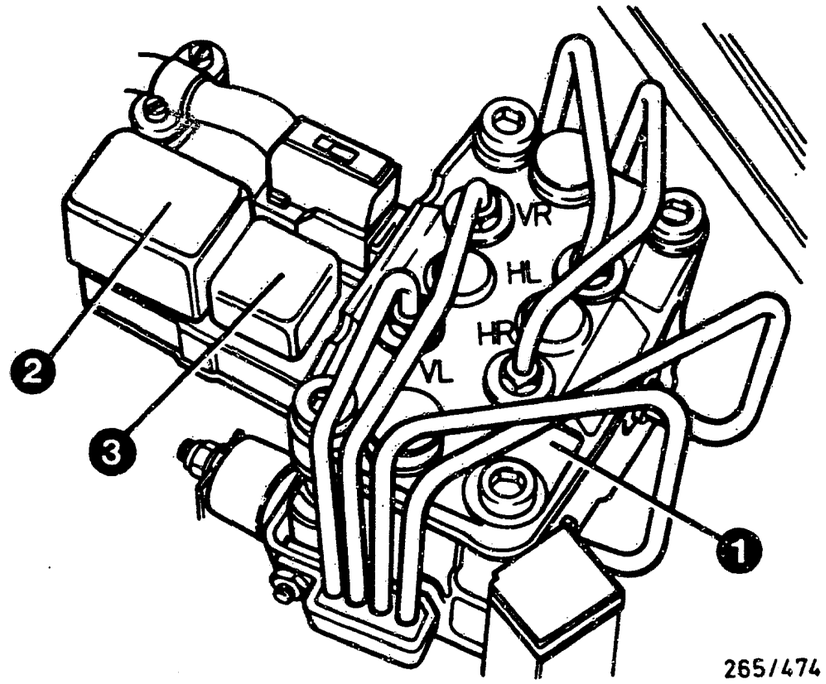
The installation locations always refer to the direction of travel.

* Controller:
  On left-hand side of trunk behind cover.

* Over-voltage protection relay:
  On left-hand side of trunk with controller

* ABS warning lamp: In instrument panel.
  Symbol: ABS.

* Stop-lamp switch:
  At brake pedal.



265/474

1 = Hydraulic modulator
2 = Motor relay
3 = Valve relay

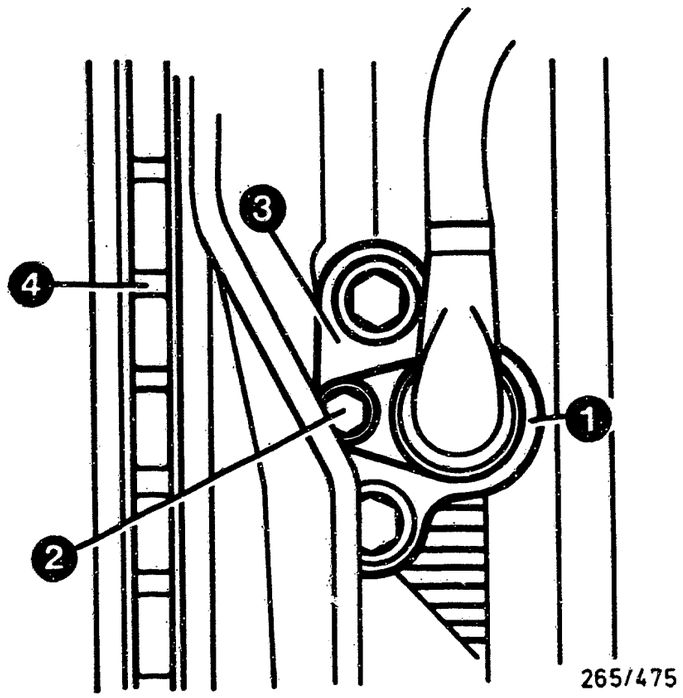
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Hydraulic modulator:
  On left-hand side of engine compartment.

  The hydraulic modulator is not to be repaired, but rather replaced as a complete assembly.
  Exception: Changing relay.

  Pay attention to correct assignment of brake-line connections.

* Ground terminal for pump motor:
  In engine compartment at left-hand fender.



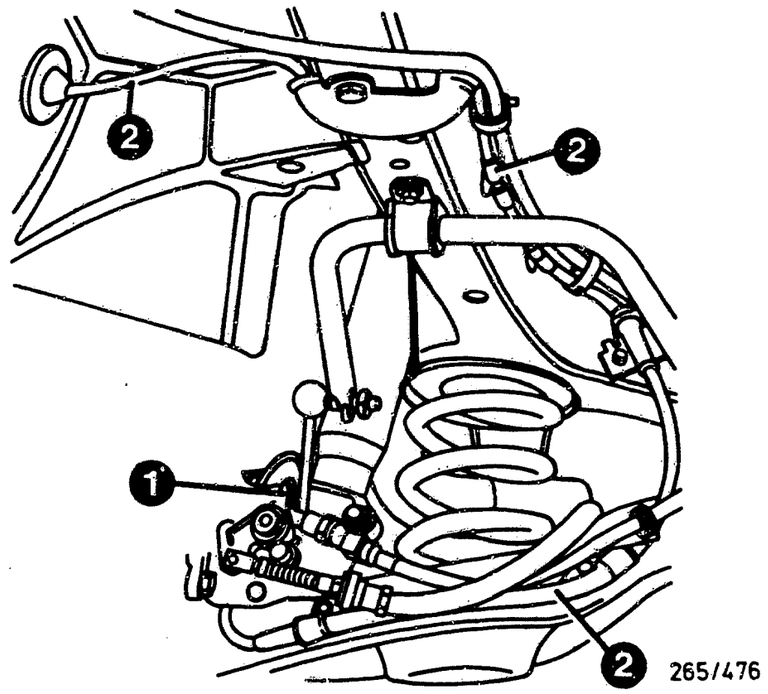
265/475

1 = Wheel-speed sensor at front wheel
2 = Wheel-speed-sensor fastening screw
3 = Support
4 = Brake disk

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Front-axle wheel-speed sensors:
  One each on left and right in steering knuckles.
  Do not remove support when removing wheel-speed sensors!

  Wheel-speed-sensor plug connections:
  On left-hand side of engine compartment in front of bulkhead and on right-hand side beneath brake master cylinder.



265/476

1 = Wheel-speed sensor (concealed) at rear wheel
2 = Wheel-speed-sensor lead

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Rear-axle wheel-speed sensors (cross-pole):
  One each on the left and right at the wheels.

  Wheel-speed-sensor plug connections:
  On left and right in trunk behind side trim.

Trouble-shooting instructions : VOL-5005

BOSCH system : LH 2.2-Jetronic

Make of vehicle : VOLVO

Basic microcard : VOL-505

TABLE OF CONTENTS

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle models with 2.316 1/4-cyl. engine:

Volvo 740 GLE
EU, AUS, CDN, and J models with catalytic converter

* As of 5/86 control unit 0 280 000 544
  As of 5/87 control unit 0 280 000 554

* Engine-speed triggering at control unit, term. 1 by way of TN signal from term. 17 of ignition control unit.

* Lambda closed-loop control with heated sensor.

* Auxiliary relay for injection valves for radio interference suppression.

* Idle-speed regulation with double-winding rotary actuator.

* Start control, i.e. additional injected fuel quantity via all solenoid-operated injection valves.

* Connect pressure gauge with connecting element KDJE-P 100/14 to pressure-regulator supply line for testing fuel pressure.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Avoid injection of fuel when testing the compression.
  To ensure this, disconnect pump relay.

For further precautionary measures, see brief instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.	2. Engine starts but then dies.	3. Rough idling (engine speed, exhaust gas).	4. Poor throttle response, flat spot during acceleration.	5. Engine misfiring (ignition, fuel injection).	6. Maximum engine power/top speed not reached.	7. Fuel consumption too high.	8. Engine running on (dieseling).	9. Engine pinging/knocking.	10. Engine overheating.	11. Fault lamp.	Cause (component fault)
*	*	*	*	*	*	*	*		*		Universal test adapter
*											Electric fuel pump
*	*	*	*								Auxiliary-air device/idle actuator
*	*	*	*	*	*	*	*				Air-flow sensor/air-mass sensor
*	*	*	*		*						Intake system
		*	*	*		*	*				Solenoid-operated injection valves
*	*	*			*	*					Fuel pressure
				*	*						Fuel quantity
		*	*	*	*	*					Throttle valve
				*							Overrun cut-off
*		*									Start control
				*							Ground
*	*	*	*	*	*						Alternator, interference suppress.
		*	*	*		*					CO exhaust-gas adjustment
				*							Control unit
						*					Catalytic converter
		*	*	*	*						Lambda closed-loop control

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ Test conditions		Set values
1	| V	5	2 – 11	Temperature-sensor resistance (engine)	Only connect adapter lead to peripherals.	+15...+30°C: Approx. +80°C:	1.45...3.3 k Ω 280...360 Ω
2	| V	6	25 – 11	Ground connection of output stage			0...10 Ω
3	| V	7	5 – 11	Ground connection of sensors			0...10 Ω
4	| V	8	13 – 11	Resistance of parallel solenoid-operated injection valves	Pull auxiliary relay out of connection frame. Connect connection 3 at plug-in frame to vehicle ground.	+15...+30°C: Approx. +80°C:	5,5...8,0 Ω 5,9...8,5 Ω
5	| V	9	3 – 11	Resistance of idle contact	Detach control-unit plug from ignition control unit.	Acc. pedal not depressed: Depress acc. pedal somewhat:	0...10 Ω Infinity Ω
6	| V	10	12 – 11	Resistance of full-load contact	Attach control-unit plug to ignition control unit.	Acc. pedal not depressed: Completely depress acc. ped:	Infinity Ω 0...10 Ω
7	| V	10	12 – 11	Resistance of idle-speed regulation test pin	Connect test pin to ground		0...10 Ω
8	| V	11	10 – 11	Resistance of idle actuator, 1st winding	Pull auxiliary relay out of plug-in frame. Connect connection 3 at plug-in frame to vehicle ground.	+15...+30°C: Approx. +80°C:	20...32 Ω 24...37 Ω

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

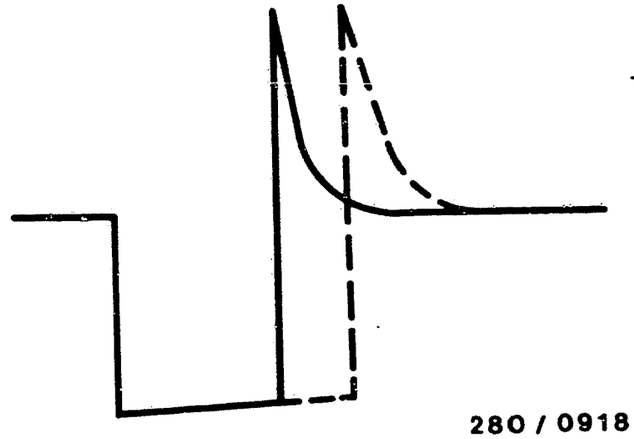
Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ Test conditions	Set values
9	| V	12	23 – 11	Resistance of idle actuator, 2nd winding	Adapter lead remains connected to peripherals. +15...+30°C: Approx. +80°C: Pull auxiliary relay out of plug-in frame. Connect connection 3 at plug-in frame to vehicle ground.	18... 30 Ω 22... 34 Ω
10	| V	13	15 – 11	Overrun-cutoff suppression (if provided)	Engage 1st or 2nd gear: Engage 3rd or 4th gear:	0...10 Ω Infinity Ω
11	| V	21	14 – 6	Resistance of idle-mixture potentiometer	Dependent on CO adjustment	10...1100 Ω
12	5	21	1 – 11	Voltage pulses from ignition coil, term. 1	Put into neutral and start	Ignition pulses on oscilloscope
13	6	21	9 – 11 (+) (–)	Voltage, main relay, term. 87	Press button 4	8...15 V
14	7	21	18 – 11 (+) (–)	Voltage, ignition and starting switch	Ignition "ON"	8...15 V
15	8	21	21 – 11 (+) (–)	Voltage at main relay, term. 85		8...15 V
16	9	21	17 – 11 (+) (–)	Voltage at pump relay, term. 85	Press button 4	8...15 V

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ Test conditions	Set values
17	10	21	16 – 11	Voltage at air-conditioner switch (only if air conditioner fitted)	Connect adapter lead to periphery and control unit. Leave engine running. Switch on air conditioner.	8...15 V
18	3	21	7 – 6	Output voltage, hot-wire air-mass sensor	Leave engine running. The output voltage must change when the engine speed changes.	2...5 V
19	11	21	22 – 11	Voltage at integrator output, lambda closed-loop control (open-loop-control value)	Leave engine running until at normal operating temperature.	10...13 V
20	11	22	22 – 11	Voltage at integrator output, lambda closed-loop control (rich value)	Leave engine running until at normal operating temperature.	10...13 V
21	11	23	22 – 11	Voltage at integrator output, lambda closed-loop control (lean value)	Leave engine running until at normal operating temperature.	Less than 0.5 V
22	11	24	22 – 11	Voltage at integrator output, lambda closed-loop control (closed-loop-control value)	Leave engine running until at normal operating temperature. Conduct measurement at approx. 2500 min $^{-1}$.	0...13 V fluctuating
23	11	24		Basic idle speed	Not applicable	

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

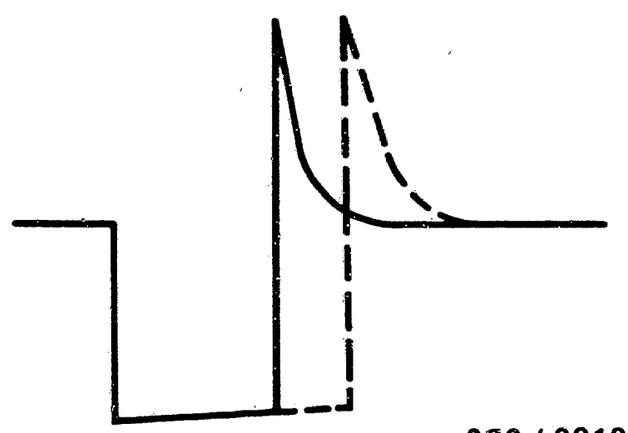
Test step	Switch V	Switch Ω	Terminals	Testing of components/function Test instructions/conditions	Set values
24	11	24		On/off ratio at idle actuator Measurement with dwell-angle tester at sockets 1 and 2 Apply LFR* test pin to ground : Loosen LFR test pin from ground: In addition, switch on air conditioner (if fitted) : Accelerate; above 3000 min $^{-1}$, on/off ratio must increase : (*LFR = Idle mixture control.)	 29...30,5 % 31... 33 % 34... 37 % > 36 %
25	12	24	13 - 11	Injection signal t_i Leave engine running (at normal operating temperature)..	See upper illustration
26	12	24	13 - 11	Injection signal t_i Temperature sensor cold Leave engine running (at normal operating temperature). Press push-button 1. Duration of injection, engine speed and CO content become greater.	See upper illustration
27	12	24	13 - 11	Injection signal t_i Temperature sensor warm Leave engine running (at normal operating temperature). Press push-button 2. Duration of injection must remain constant.	See upper illustration



280 / 0918

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 141

Test step	Switch V	Switch Ω	Terminals	Testing of component/function Test instructions/conditions	Set values
28	12	24	13 – 11	Injection signal t_i Overrun cutoff Allow warm engine to run at 2000 min^{-1}. Press button 5. Injection signals cut out and cut in again at approx. 1300 min^{-1}. Engine hunts.	See top picture
29	12	24	13 – 11	Injection signal t_i Full-load enrichment Run warm engine. Press button 6. Injection time, engine speed and CO content increase.	See top picture
30	13	24	8 – 11	Hot-wire air-mass sensor Self-cleaning function Engine must run at in excess of 2000 min^{-1} and the engine temperature must be greater than + 60°C. Then ignition "off" – voltage reading after approx. 4 s.	2...5 V Reading displayed for approx. 1 s



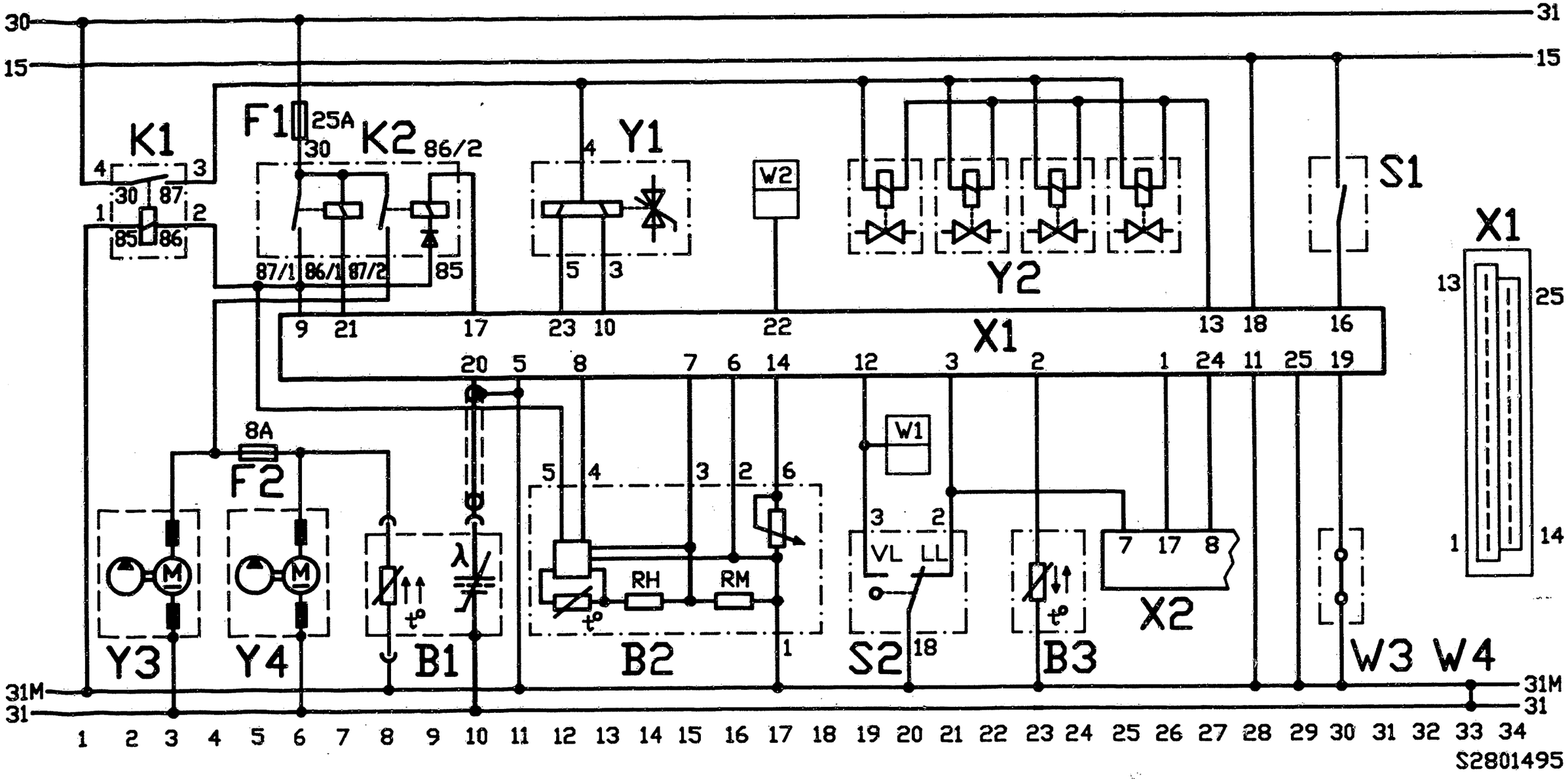
280 / 0918

TEST SPECIFICATIONS

Component/Function	Set values
Electric fuel pump	
* Fuel delivery at return:	at least 700 cm ^{3} /30 s
* Supply voltage under load:	at least 12 V
* Fuel delivery of pre-supply pump:	at least 800 cm ^{3} /30 s
Pressure regulator	
* Fuel pressure with engine at standstill:	2,3...2,7 bar
at idle:	approx. 0.5 bar lower
Fuel system, leaks	
* Fuel pressure after 20 mins with engine at standstill:	at least 1.0 bar
Idle actuator	
* Resistance value at +15...+30°C between	
term. 4 and term. 5:	17.?.22,5 Ω
term. 4 and term. 3:	19...25,0 Ω
Hot-wire air-mass sensor	
* Resistance value between	
term. 6 and term. 2:	0...1100 Ω
term. 3 and term. 2:	3.6...4.1 Ω
Temperature sensor (engine)	
Double version	
* Internal electrical resistance at ambient temperature	
+15...+30°C:	1.45...3.3 k Ω
with engine at normal op.temp. approx. +80°C :	280...360 Ω

TEST SPECIFICATIONS (Continued)

Component/function	Set values
Solenoid-operated injection valve	
* Internal resistance at ambient temperature +15...+30°C:	14.5...17.5 Ω
* Leakage after 60 s:	No droplets may drip off
Start control	
* Voltage at injection valve on start initiation:	Greater than 1.5 V
after approx. 15 s:	Approx. 0.5 V
Idle-speed adjustment	
Engine at operating temperature,	approx. +80°C
* Idle speed:	730...770 min $^{-1}$
with on/off ratio:	31... 33 %
CO adjustment	Integrator voltage
Engine at op. temp. approx. 80°C	(Test pin, term. 22)
* Open-loop control (disconnect plug conn. of sensor lead):	Fixed voltage value between 10...13 V
* Closed-loop control (fit plug connection together):	Reading fluctuates between 0...13 V
* Adjustment:	Uniformly fluctuating reading between 0...13V
* Rich value (disconnect plug connection and connect control-unit lead to ground):	10...13 V
* Lean value (apply 2V to control-unit lead):	Less than approx. 1.0 V
Lambda-sensor heater	
* Internal resistance	1...15 Ω



B1 = Heated lambda sensor
B2 = Hot-wire air-mass sensor
B3 = Temperature sensor (engine)
F1 = Main/pump fuse
F2 = Sensor-heater fuse
K1 = Auxiliary relay (interference supp.)
K2 = Main/pump relay
S1 = Air-conditioning switch
S2 = Throttle-valve switch
W1 = Test pin idle-speed regulation
W2 = Test pin, integrator voltage (lambda)
W3 = TV encoding (lambda)
W4 = Engine ground strap
X1 = Control-unit plug - Jetronic
X2 = Control-unit plug - ignition
Y1 = Idle actuator
Y2 = Solenoid-operated injection valves
Y3 = Electric fuel pump
Y4 = In-tank pre-supply pump

ELECTRICAL TERMINAL DIAGRAM

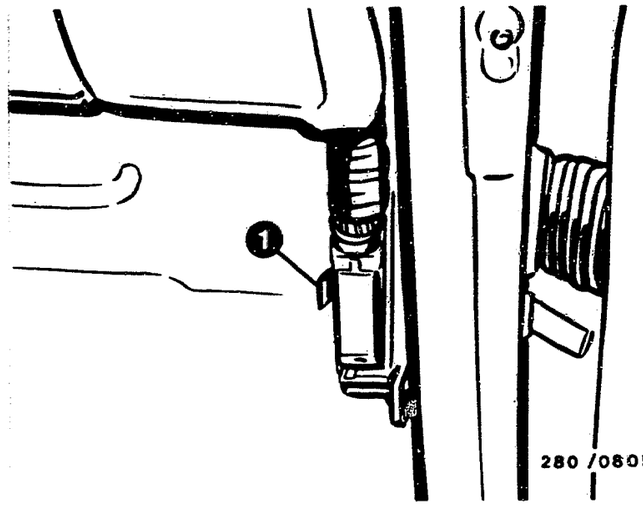
L17 — ⟹

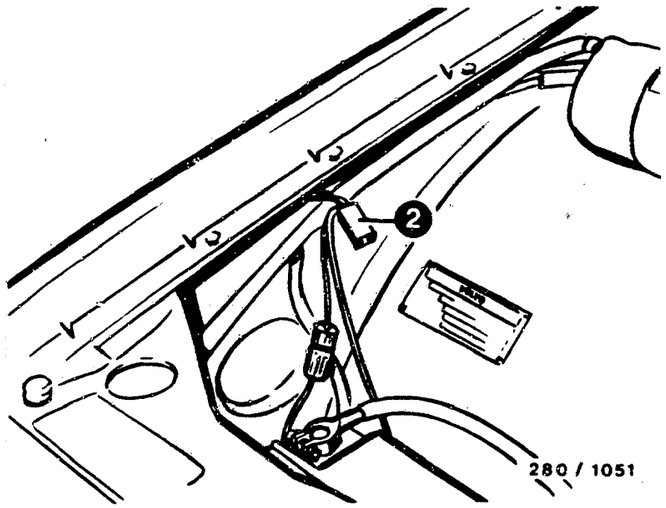
L18 — ⟸

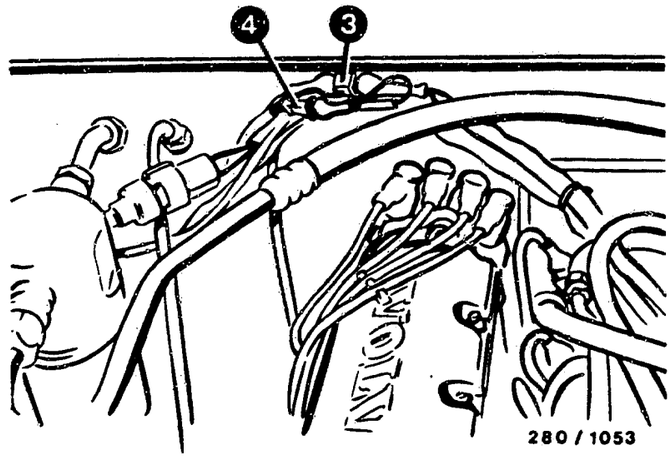
INSTALLATION POSITION OF COMPONENTS

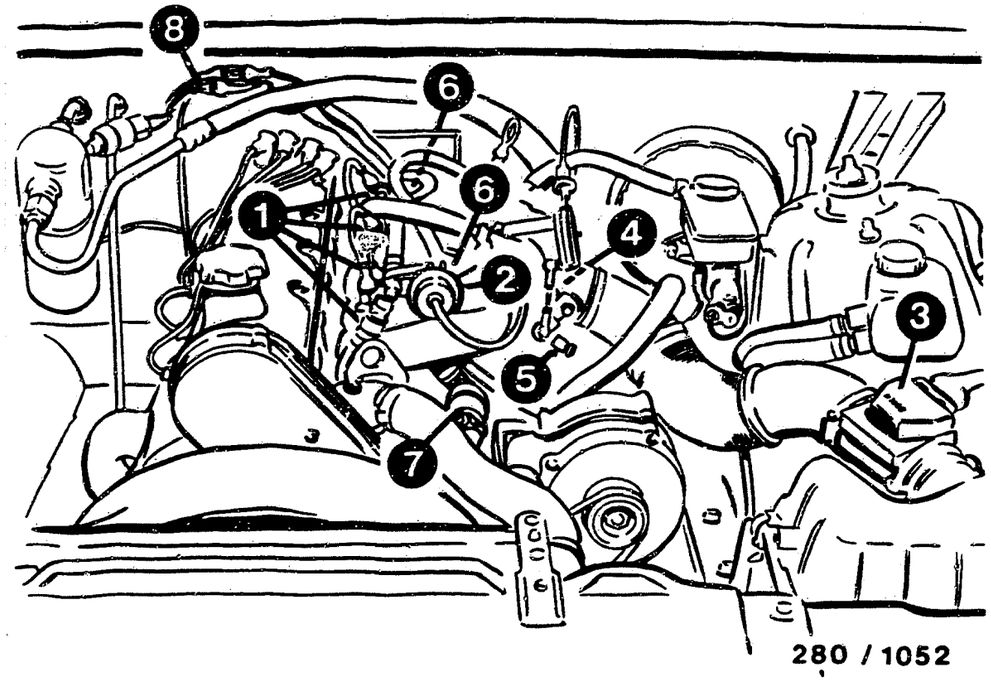
1 = Control unit
2 = Test pin (IMC- red/white) integrator output (green/white)
3 = Plug connection, lambda-sensor heater
4 = Plug connection, lambda sensor

The control unit is located on the right in the passenger-side footwell behind a cover.
The pump fuse as well as the main and pump relays are located in the passenger-compartment center console behind the ashtray.









1 = Solenoid-operated injection valves
2 = Pressure regulator
3 = Hot-wire air-mass sensor
4 = Throttle-valve switch
5 = Adjusting screw for on/off ratio (idle-speed regulation)
6 = Ground terminal
7 = Idle actuator
8 = Lambda-sensor plug connection

INSTALLATION POSITION OF COMPONENTS (Continued)

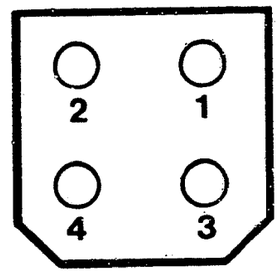
Temperature sensor (engine) is located between 3rd and 4th solenoid-operated injection valves beneath the intake manifold.

L21 — ⟺

For production reasons:
continued on the following coordinate.

L22 — ⟺

* Top picture
  The auxiliary relay is attached to the container for the windscreen washer system.
  The picture gives a view of the plug-in frame with terminals.



280 / 1496

* Center picture
  1 = Electric fuel pump
  2 = Fuel filter
  3 = Fuel suction line
  4 = Fuel delivery line

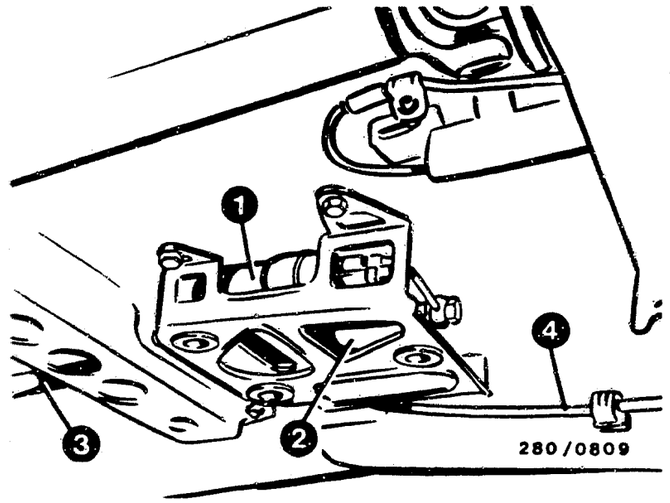
Pre-supply pump in tank (accessible via trunk)

* Bottom picture
  1 = Pressure gauge
  2 = Connecting element KDJE-P 100/14

Fuel pressure test

Connect pressure gauge or pressure measuring instrument. Unscrew fuel delivery line at fuel distributor pipe.
Fit connecting element KDJE-P 100/14 in line.
Ensure leakproof connection.

IMPORTANT! Make sure no fuel gets on to hot parts of the engine when the hose is unscrewed.



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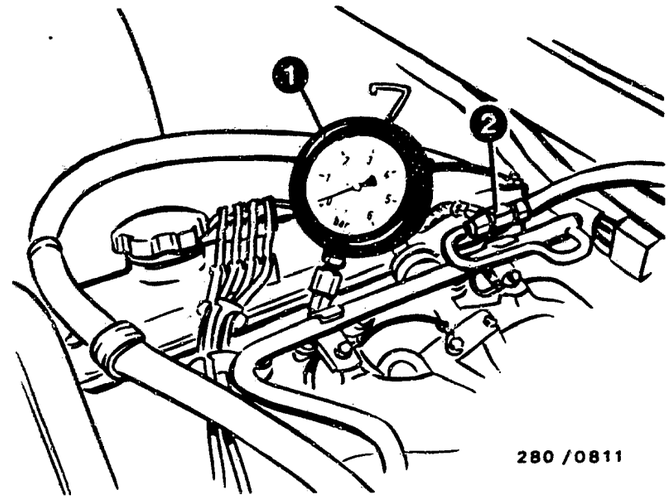


280 /0811

Trouble-shooting instructions : BMW-5021

BOSCH system : Electronic transmission control (GS)

Make of vehicle : BMW

Basic microcard : BMW-528

TABLE OF CONTENTS

SPECIAL FEATURES

These trouble-shooting instructions, valid at the time of publication, apply to the following vehicle models:

* BMW 320i with 2.0 l / 6 cyl. engine as of 1.87
  BMW 325i with 2.5 l / 6 cyl. engine as of 1.87
  BMW 325iX with 2.5 l / 6 cyl. engine as of 1.87
  BMW 325e with 2.7 l / 6 cyl. engine as of 1.87

* Electronic transmission control GS 1.1b (testing as for GS 1.1 with universal test adapter and adapter lead 1 684 463 161).

* Control unit has 35-pole plug.

* Failure/anti-switchdown unit.
  Function: The task of the failure/anti-switchdown unit is to prevent switchdown from 4th to 3rd gear at high speeds (e.g. when actuating the kick-down switch). 4th gear is likewise retained when travelling at high speeds in position "D" should the control unit fail. This means that the engine cannot be overreved even for brief periods.

If no faults are found in the transmission control, trouble-shooting is to be continued with the Motronic system.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Transmission oil:

With automatic transmissions, even slight deviations from the specified oil level or incorrect grade of oil can lead to a noticeable deterioration in the quality of shifting. Major deviations may even result in incorrect shifting.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Fault lamp	2. Engine fails to start.	3. Engine dies in driving position.	4. No or faulty shift function.	5. Shift transitions not O.K.	6. No full-load shifting	7. Full-load shifting only	8. Manual shiftdown not O.K.	9. Hard engagement impact when engaging reverse gear	10. Reverse cannot be selected	Cause (component fault)
*	*									Main relay defective
*										Voltage at GS control unit
			*	*						Throttle-valve sensor
	*		*							Open-circuit in ground terminal or contact resistance
*			*							Plug at transmission dropped off or defective
	*									Start blocking relay
	*		*	*						Position switch
			*	*			*			Program-selector switch
		*								Idle contact
		*								Idle actuator
		*								Idle speed
					*					No kick-down contact
						*				Kick-down perm. connect. to ground
*				*				*		Pressure regulator
				*						No engine action
			*	*						Solenoid valve(s)
			*							Engine-speed sensor
		*								No conv. and clutch unit release
				*						Interference
*			*	*	*	*	*	*	*	GS control unit defective
			*		*					Failure/anti-shiftdown unit

Rapid diagnosis chart for universal test adapter with adapter lead 1 684 463 161

Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
1	V	1	Position switch in position "P". Ignition off. Detach transmission control unit and pump relay. Measure insulation resistance of engine-speed-sensor screen. Term. 23 with respect to term. 5 (ground)	Greater than 100 k Ω	* Engine-speed sensor * Lead (or screen)
2	V	2	Measure insulation resistance of engine-speed sensor. Term. 8 with respect to term. 5	Greater than 100 k Ω	
3	V	3	Measure insulation resistance between screen and engine-speed-sensor lead. Term. 23 with respect to term. 27	Greater than 100 k Ω	
4	V	4	Measure winding resistance of engine-speed sensor. Term. 8 with respect to term. 27.	0.7 ... 1.8 k Ω	
5	V	5	Measure shunt resistance of kick-down switch. Do not depress accelerator pedal Term. 2 with respect to term. 5.	Greater than 100 k Ω	* Kick-down switch
6	V	6	Measure insulation resistance of solenoid valves and pressure regulator in transmission. Term. 1 with respect to term. 5.	Greater than 100 k Ω	* Leads * Solenoid valves (in transmission) * Pressure regulator (in transmission)
7	V	7	Not applicable		
8	V	8	Program-selector switch of vehicle in position "S". Measure insulation resistance of program-selector switch. Term. 14 with respect to term. 5	Greater than 100 k Ω	* Program switch
9	V	9	Test connection between term. 10 and term. 6.	Greater than 100 k Ω	*(Term. 10 must be open)
10	V	10	Test connection between term. 26 and term. 6.	Greater than 100 k Ω	*(Term. 26 must be open)

Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
11/12	V	11/12	Deleted		
13	V	13	Test warning lamp for electronic transmission control. Measure resistance between term. 33 and term. 5.	10 ... 150 Ω	* Warning lamp for transmission control * Connector, shift indicator
14	V	14	Depress accelerator pedal as far as it will go. Measure resistance of kick-down switch. Term. 2 with respect to term. 5	Less than 10 Ω	* Kick-down switch * Connector
15	V	15	Measure resistance of ground leads between term. 19 and term. 5.	Less than 10 Ω	* Ground leads * Contact resistances
16	V	16	Measure winding resistance of solenoid valve 1 (in transmission). Term. 16 with respect to term. 1	25 ... 65 Ω	* Transmission plug connection * Solenoid valve 1
17	V	17	Measure winding resistance of solenoid valve 2 (in transmission). Term. 17 with respect to term. 1.	25 ... 65 Ω	* Transmission plug connection * Solenoid valve 2
18	V	18	Measure winding resistance of solenoid valve for reverse-gear lock (in transmission). Term. 20 with respect to term. 1.	25 ... 65 Ω	* Transmission plug connection * Solenoid valve, reverse-gear lock
19	V	19	Measure winding resistance of solenoid valve for converter and clutch unit (in transmission). Term. 25 with respect to term. 1.	25 ... 65 Ω	* Transmission plug connection * Solenoid valve, converter and clutch unit
20	V	20	Measure winding resistance of pressure regulator (in transmission). Term. 22 with respect to term. 1	4.5 ... 9 Ω	* Transmission plug connection * Pressure regulator
21	V	21	Not applicable		

Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
22	3	22	Voltage measurement: Ω switch position "22"; V switch position " 3". Position switch in position "P". Pull on handbrake. Measure supply voltage for transmission control. Term. 35 with respect to term. 5	10 ... 15 V	* Main relay (term. 87) * Plug connection to Motronic (13-pole) * Corresponding leads
23	4	22	Position switch in position 1. Measure voltage. Term. 18 with respect to term. 5	Greater than 6 V	* Position switch * Corresponding plug connections and leads
24	4	22	Position switch in position 2. Measure voltage. Term. 18 with respect to term. 5.	Less than 1 V	
25	5	22	Position switch in position 2. Measure voltage. Term. 28 with respect to term. 5.	Greater than 6 V	
26	5	22	Position switch in position 3. Measure voltage. Term. 28 with respect to term. 5.	Less than 1 V	
27	6	22	Position switch in position 3. Measure voltage. Term. 29 with respect to term. 5.	Greater than 6 V	
28	6	22	Position switch in position D. Measure voltage. Term. 29 with respect to term. 5.	Less than 1 V	
29	7	22	Position switch in position D. Measure voltage. Term. 30 with respect to term. 5.	Greater than 6 V	
30	7	22	Position switch in position N. Measure voltage. Term. 30 with respect to term. 5.	Less than 1 V	
31	8	22	Position switch in position N. Measure voltage. Term. 4 with respect to term. 5.	Greater than 6 V	
32	8	22	Position switch in position R. Measure voltage. Term. 4 with respect to term. 5.	Less than 1 V	

Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
33	8	22	Position switch in position "P". Measure voltage. Term. 4 with respect to term. 5.	Less than 1 V	* Position switch
34	9	22	Switch off ignition. Connect sockets 1 and 2 with a lead or with the ammeter (1.5 A). Position switch in position "P". Connect control unit. Switch on ignition. Move program-selector switch to position "E". Measure voltage (term. 15 with respect to term. 5). Comply with operating sequence!	Greater than 4 V	* Program-selector switch
35	9	22	As test step 34, however program-selector-switch setting "M"	Less than 0,8 V	
36	10	22	As test step 35, however measure term. 14 with respect to term. 5.	Greater than 4 V	
37	10	22	As test step 36, however program-selector-switch setting "E".	Less than 0,5 V	
38	11	22	Not applicable		
39/40	12/13	22	Deleted		
41	14	22	Test voltage supply of throttle-valve sensor. Measure term. 9 with respect to term. 5.	Greater than 4 V	* Control unit
42	15	22	Measure voltage at tap of throttle-valve sensor - term. 7 with respect to term. 5 - with accelerator pedal not depressed.	Less than 1 V	* Throttle-valve sensor and setting * Plug connection to Motronic (13-pole)
			As above, however full throttle.	Greater than 4 V	
43.1	16	22	Fit pump relay, let engine run and move program-selector switch to position "S". Warning lamp for transmission control lights up until self-test has been successfully completed.	Warning lamp for transmission control goes out following self-test	* No ti/Tr signal * Lead, engine action term. 24 to Motronic control unit term. 51 * Control unit * Solenoid valves

Rapid diagnosis chart for universal test adapter (continued)

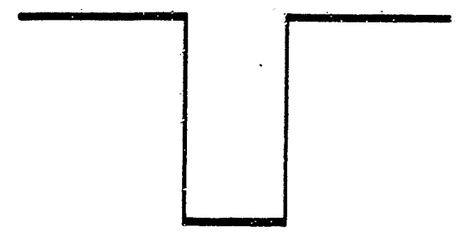
Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
43.2	16	22	Position switch in position "N". Engine idling. Measure voltage. Term. 20 with respect to term. 5.	10...15 V	* Control unit (output, reverse-gear lock)
44	17	22	As test step 43.2 however Term. 16 with respect to term. 5.	Less than 1 V	* Control unit (output, solenoid valve 1)
45	18	22	As test step 43.2 however Term. 17 with respect to term. 5.	Less than 1 V	* Control unit (output, solenoid valve 2)
46	19	22	As test step 43.2 however Term. 25 with respect to term. 5.	10...15 V	* Control unit (output, converter and clutch unit)
47	16	22	Drive vehicle on to chassis dynamometer. Program-selector switch in position "S", position switch to "D". Slowly bring speed up to approx. 20 km/h. Term. 20 with respect to term. 5.	Less than 1 V at approx. 20 km/h +)	* Control unit (output, reverse-gear lock) * No engine-speed-sensor signal (test steps 58, 59)
48	17	22	As test step 47, however driving speed approx. 45 km/h. Term. 16 with respect to term. 5.	10...15 V At approx. 45 km/h +)	* Control unit (output, solenoid valve 1) * No engine-speed-sensor signal
49	18	22	As test step 47, however driving speed approx. 80 km/h. Term. 17 with respect to term. 5.	10...15 V at approx. 80 km/h +)	* Control unit (output, solenoid valve 2) * No engine-speed-sensor signal

+) Important! Deviations in the above speeds may be encountered due to differing engine size and differing transmission ratios.

Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
50	19	22	Take foot off accelerator pedal following test step 49, briefly switch ignition off and on again. Slowly increase speed to approx. 100 km/h. Otherwise as test step 47. Term. 25 with respect to term. 5.	Less than 1 V at approx. 100 km/h +)	* Control unit (output, converter and clutch unit) * No engine-speed-sensor signal
51	20	22	Not applicable		
52	20	22	Vehicle on chassis dynamometer. Engine idling. Position switch on "D". Measure current at sockets 1 and 2 of universal test adapter. (Current measurement in lead 22). Caution: do not cause short-circuit to ground!	900...1000 mA	* Control unit (output, pressure regulator)
53	20	22	As test step 52, however accelerate briefly	Reading decreases	
54	21	22	Vehicle on chassis dynamometer Program-selector switch in position "M". Position switch on "1". Increase engine speed to in excess of 1500 min $^{-1}$, switch position switch to "2" etc. Observe signal term. 24 with respect to term. 5 on oscilloscope.	Approx. 1 s following gear change 1 - 2 negative pulses (see top picture)	* Connection, transmission control unit term. 24 and Motronic control unit term. 51 via 13-pole plug * Transmission control unit (output, engine action) * Motronic control unit

+) Important! Deviations in the above speeds may be encountered due to differing engine size and differing transmission ratios.

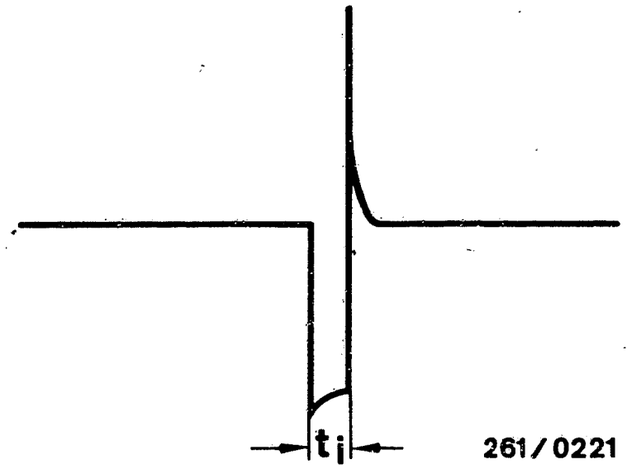


261/337

Engine-action signal

Rapid diagnosis chart for universal test adapter (continued)

Test step	Switch position V	Switch position Ω	Remarks	Test specifications (indication)	Cause of fault
55	21	22	Not applicable		
56	22	22	Vehicle on chassis dynamometer. Program-selector switch in position "S". Position switch in position "D". Engine idling. Connect oscilloscope to test recesses. Measure t_i signal. Term. 11 with respect to term. 5.	Signal see top picture.	* Plug connection to Motronic (13-pole) * Motronic control unit
57	23	22	As test step 56, however measure Tr signal. Term. 21 with respect to term. 5.	Signal see center picture.	
58	2	22	As test step 56, however driving speed approx. 10 km/h. Measure engine-speed-sensor signal. Term. 8 with respect to term. 5.	Signal see bottom picture (a)	* Transmission plug connection (pin terminal at transmission) * Engine-speed sensor in transmission (incorrect setting)
59	2	22	As test step 58, however driving speed approx. 20 km/h. Signal frequency and voltage magnitude increase.	Signal see bottom picture (b)	



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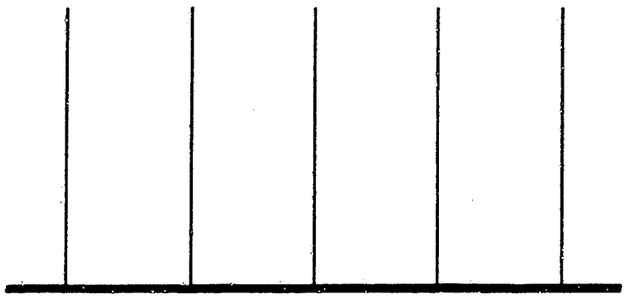
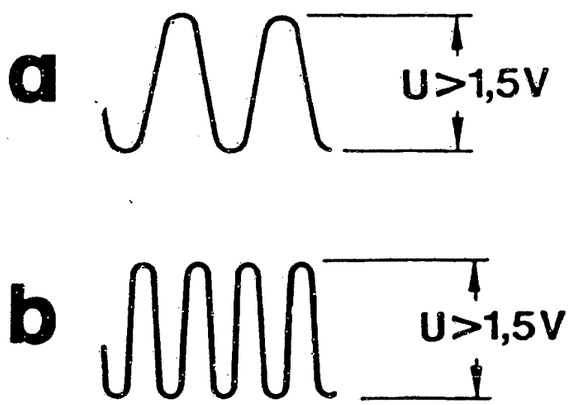

261/116



261/339

TEST SPECIFICATIONS

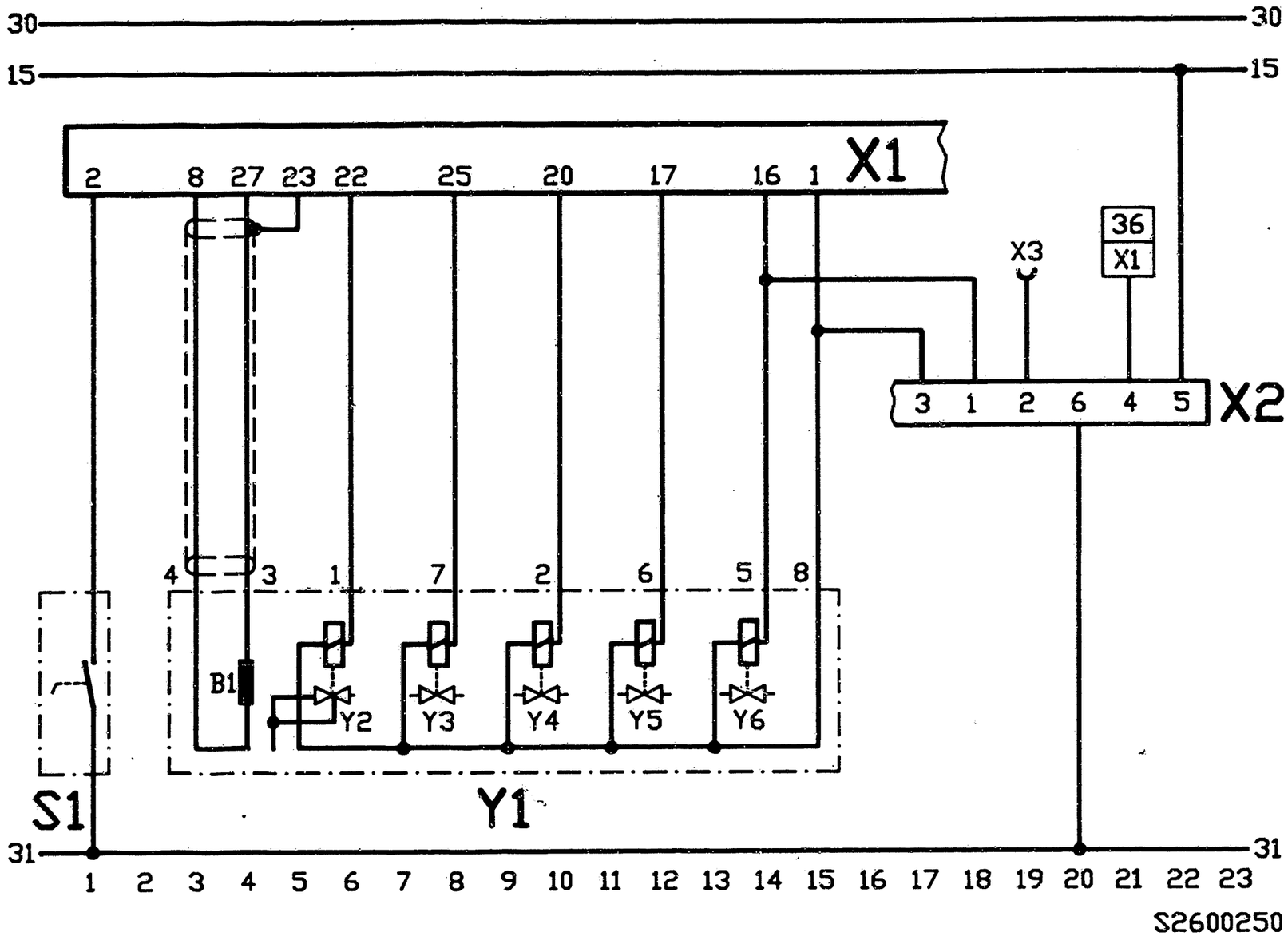
The test specifications indicated apply to measurements directly at the component or at the 35-pole plug without connected test adapter.

Eng.-speed sensor (in transmission):	0.7 ... 1.8 k Ω
Pressure reg. (in transmission):	1.7 ... 4.5 Ω
Solenoid valves (in transmission) SV1 and SV2, reverse-gear lock and converter/clutch unit:	22 ... 60 Ω in each case
Kick-down switch actuated:	approx. 0 Ω
Position switch (driving-position switch) in position 1, 2, 3, D, N, R, P:	U_B with ignition switched on.
Program-selector switch in positions E and M:	approx. 0 Ω with respect to ground in each case.

Throttle-valve potentiometer:

Total resistance between pin 1 and pin 2 :	3...5 k Ω
Wiper resistance between pin 3 and pin 2 (potentiometer removed and on idle stop) :	250...800 Ω

For production reasons:
continued on the following coordinate.

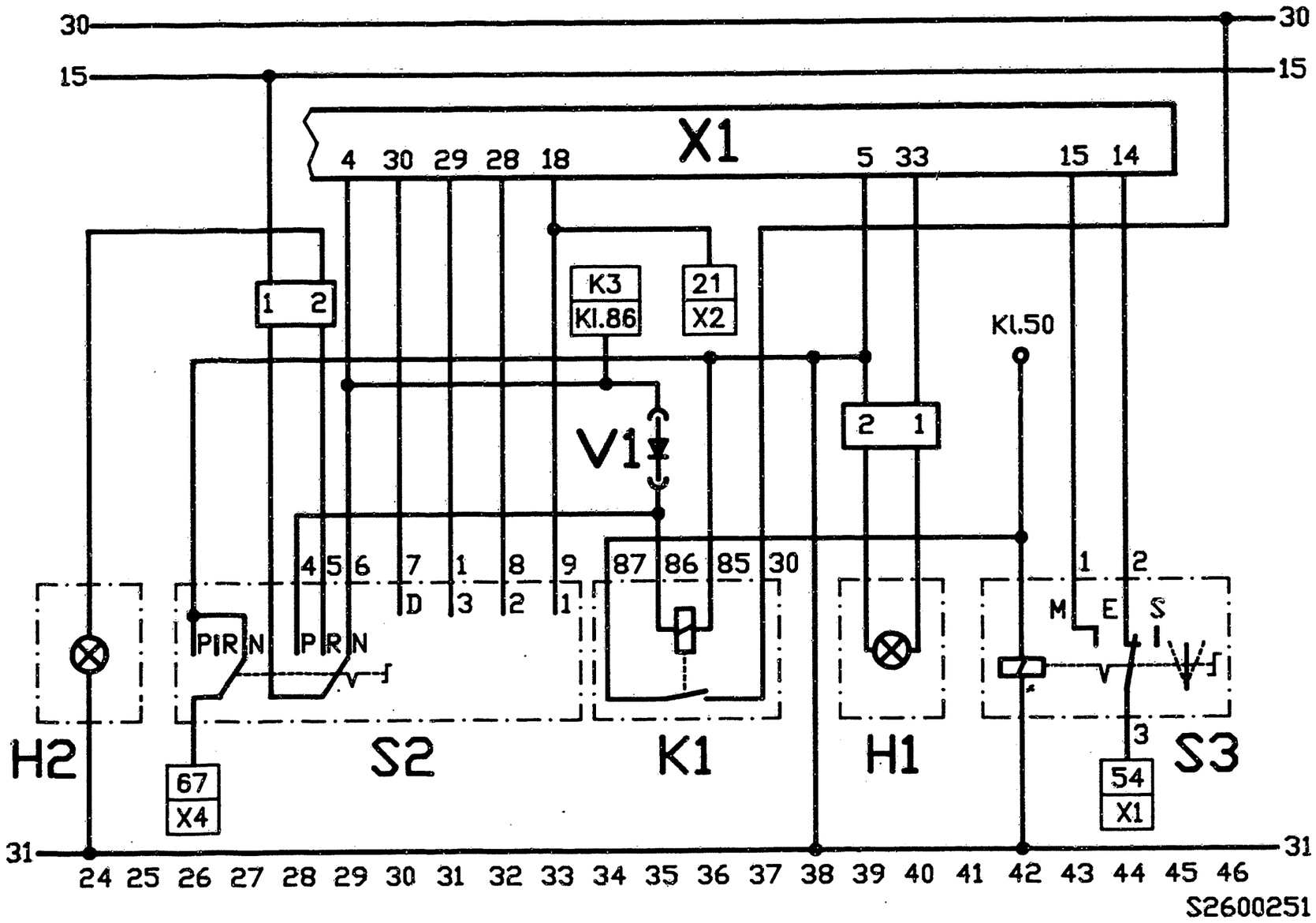


S2600250

B1 = Output-speed sensor
S1 = Kick-down switch
X1 = GS control-unit plug
X2 = Connector for failure/ anti-shiftdown unit
X3 = Connection, speedometer signal

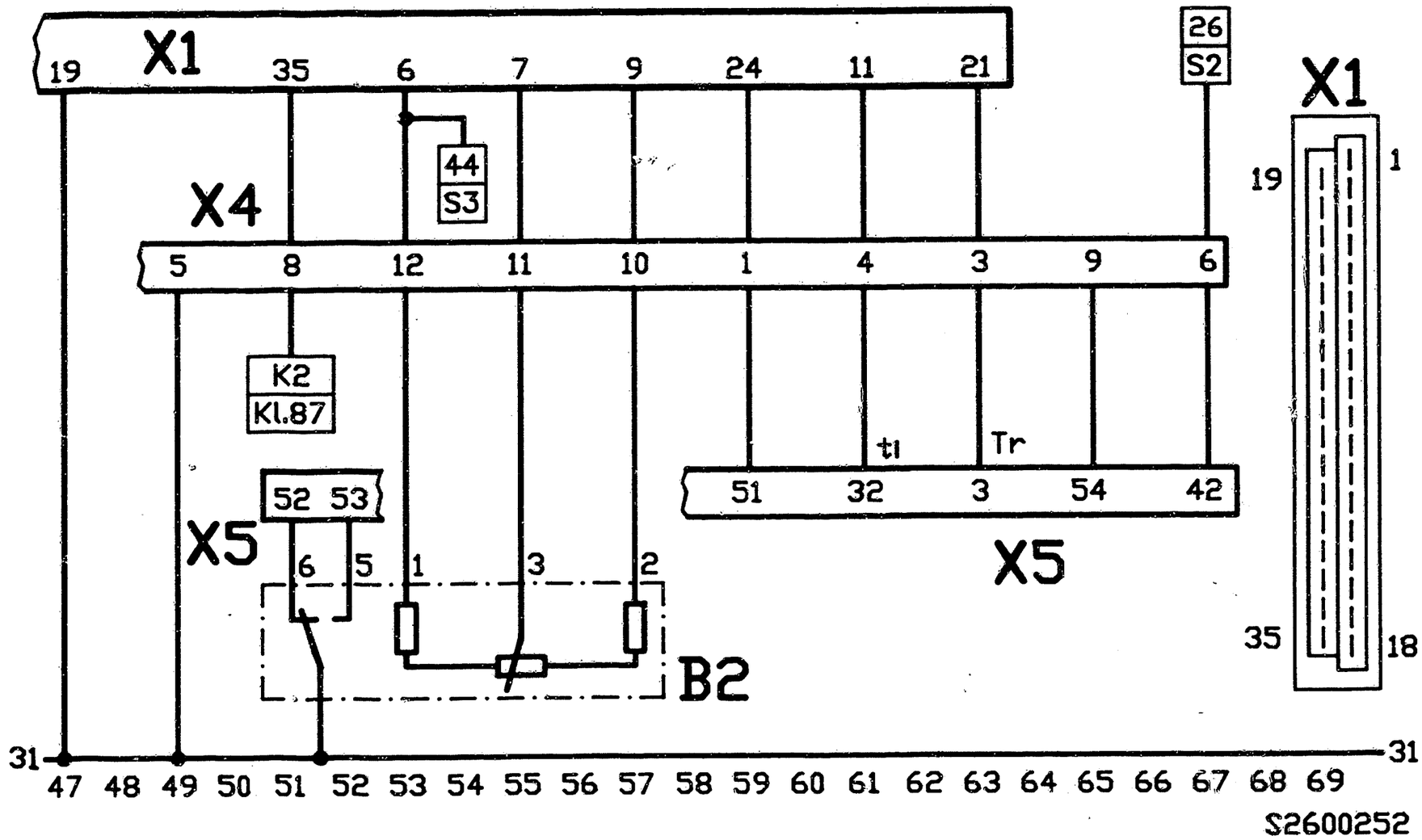
Y1 = Transmission section with switching valves, pressure regulator and engine-speed sensor (8-pole pin terminal at transmission):
Y2 = Pressure regulator
Y3 = Solenoid valve (converter and clutch unit)
Y4 = Solenoid valve, reverse-gear lock
Y5 = Solenoid valve 1
Y6 = Solenoid valve 2

ELECTRICAL TERMINAL DIAGRAM



H1 = Warning lamp for transmission control
H2 = Reversing lamp
K1 = Start blocking relay
K3 = ABS relay (325iX only)
S2 = Position switch (driving-position switch)
S3 = Program-selector switch
V1 = Diode
X1 = GS control-unit plug
X2 = Connector for failure/anti-shiftdown unit

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)



B2 = Throttle-valve potentiometer
K2 = Main relay (Motronic)
S2 = Position switch (driving-position switch)
S3 = Program-selector switch
X1 = GS control-unit plug
X4 = 13-pole plug connection to Motronic
X5 = Motronic control-unit plug

ELECTRICAL TERMINAL DIAGRAM (CONTINUED)

INSTALLATION POSITION OF COMPONENTS

Control unit for electronic transmission control:
Side panel, rear left, in trunk
(remove partial lining)

Failure/anti-shiftdown unit:
In trunk, left (remove partial lining, jack and wheel brace and lift off trunk lining)

Engine-speed sensor, switching valves, pressure regulator:
In transmission

Connectors for engine-speed sensor, switching valves, pressure regulator:
At transmission (top picture; arrows)
Plug assignment, see center picture

1 = Engine-speed sensor
2 = Voltage supply (10...15 V)
3 = Solenoid valve 1
4 = Solenoid valve 2
5 = Pressure regulator
6 = Solenoid valve (converter and clutch unit)
7 = Solenoid valve (reverse-gear lock)

Main relay (for Motronic and transmission control):
In engine compartment, in front of left-hand spring-strut dome (see corresponding Motronic microcard).

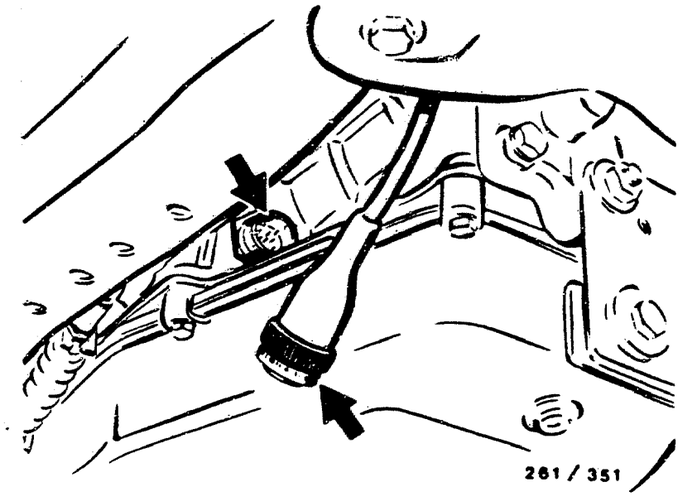
Plug connection (13-pole) for Motronic wiring harness:
Bulkhead, right, inside.

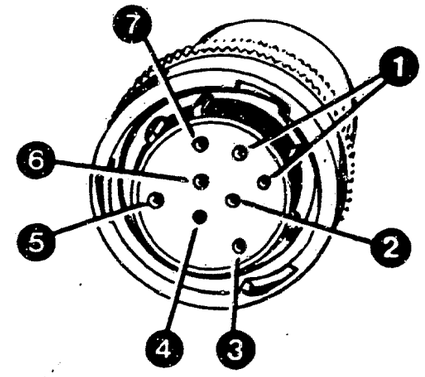
Kick-down switch:
Beneath accelerator pedal

Throttle-valve switch with built-in potentiometer and 6-pole round connector (bottom picture):
At throttle-valve assembly, bottom.

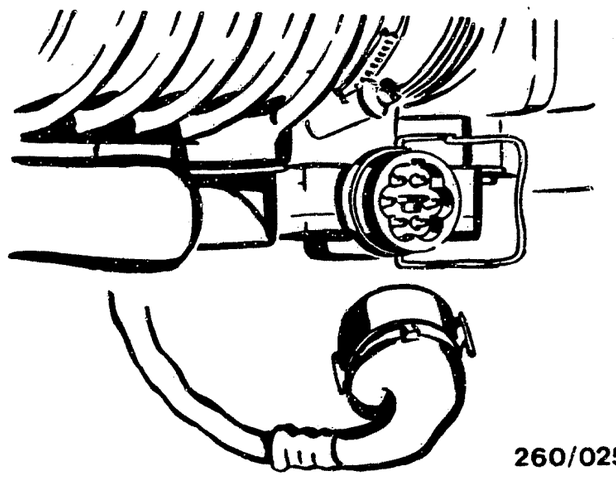
N o t e :

Effect adjustment via idle contact, then check voltage at plug between term. 3 and term. 2 – switch on ignition;
accelerator pedal not depressed : < 1 V
accelerator pedal fully depressed: > 4 V





261/352



260/0253

Trouble-shooting instructions : PEU-5000

BOSCH system : LU 1-Jetronic

Make of vehicle : PEUGEOT

Basic microcard : PEU-506

TABLE OF CONTENTS

SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following vehicle model with
2.155 1/4-cyl. engine N9TEA :

PEUGEOT 505 i Turbo
USA version 5.85->
EU version 11.85->

* LU1 Jetronic with 25-pole control unit: 0 280 000 343.
* Twin temperature sensor installed as of 11/86.
* Engine-speed triggering by way of TD signals from term. 17 of ignition control unit.
* Solenoid-operated injection valves with copper wire coil and series resistor.
* Auxiliary relay for solenoid-operated injection valves and control unit.
* Lambda closed-loop control with heated sensor.
* Enrichment signal from ignition control unit.
* Pre-supply pump
* Pressure sensor for altitude compensation.
* Suppression of overrun cutoff by +60°C temperature switch.
* Exhaust turbo-supercharger and 3-way exhaust catalytic converter.
* Charge cooler and charge-air pressure switch.
* Tank ventilation system.

STRUCTURE AND USAGE

These brief instructions encompass essentially vehicle-specific special features and test specifications (set values).

In accordance with the customer complaint, the trouble-shooting chart leads to different causes/component faults.
For a detailed description of trouble-shooting, see the information in the trouble-shooting chart of the basic instructions.

ATTENTION: Even if reference is made to basic instructions, the set values, terminal assignments and special features of these vehicle-related brief instructions are always binding.

SAFETY AND PRECAUTIONARY MEASURES

In order to keep persons out of danger and to avoid damage to the engine, trigger boxes and control units or to the ignition system, observe the information in the basic instructions.

CAUTION!
High-performance ignition system with dangerous primary and secondary voltages!

Touching voltage-carrying components or terminals may prove fatal (both on the primary and secondary sides).

* Prevent fuel from being injected during the compression test.
For this reason, disconnect control relay.

For further precautionary measures, see basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (symptom of trouble)

1. Starting motor operates, but engine fails to start or starts only with difficulty.
2. Engine starts but then dies.
3. Rough idling (Engine speed, exhaust gas).
4. Poor throttle response, flat spot during acceleration.
5. Engine misfiring (ignition, fuel injection).
6. Maximum engine power/top speed not reached.
7. Fuel consumption too high.
8. Engine running on (dieseling).
9. Engine pinging/knocking.
10. Engine overheating.
11. Fault lamp.

1	2	3	4	5	6	7	8	9	10	11	Cause (component fault)
*	*	*	*	*	*	*	*		*		Universal test adapter
*											Electric fuel pump
*	*	*	*								Auxiliary-air device/idle actuator
*	*	*	*	*	*	*	*				Air-flow sensor/air-mass sensor
*	*	*	*		*						Intake system
		*	*	*		*	*				Solenoid-operated injection valves
*	*	*			*	*					Fuel pressure
				*	*						Fuel delivery
		*	*	*	*	*					Throttle valve
*	*	*				*					Cold-start valve
*		*									Thermo-time switch
				*							Frame connection
*	*	*	*	*	*						Alternator, interference suppress
		*	*	*		*					CO exhaust-gas adjustment
				*							Control unit
						*					Catalytic converter
		*	*	*	*						Lambda closed-loop control

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 123

Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ test conditions	Set values
1	5	–	1 – 5	TD pulses from ignition control unit, term. 17	Put into neutral and start	TD pulses on oscilloscope
2	6	–	9 – 5 (+) (–)	Voltage, control relay, term. 87	Put into neutral and start	8...15 V
3	7	–	4 – 5 (+) (–)	Voltage, ignition and starting switch, term. 50	Put into neutral and start	8...15 V
4	8	–	11 – 5 (+) (–)	Voltage, pressure sensor (altitude sensor)	Switch on ignition At atmospheric pressure: 980 mbar (altitude approx. 300 m) 615 mbar (altitude approx. 4000m)	 2.0...4.0 V 8.0...12.0 V
5	| V	11	8 – 5	Resistor combination in air-flow sensor		100...200 Ω
6	| V	12	7 – 5	Resistance of potentiometer in air-flow sensor	Deflect air-flow sensor flap as far as it will go.	60...1000 Ω
7	| V	13	10 – 5	Resistance, temperature sensor, engine	+15...+30°C: approx. +80°C:	1,45...3,3 k Ω 280...360 Ω
8	| V	14	13 – 5	Ground connection of output stage		0...10 Ω

N05 — ⟹

N06 — ⟺

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01
Adapter lead: 1 684 463 123

Test step	Switch V	Switch Ω	Terminals	Testing of component/function	Test instructions/ test conditions	Set values
9	|	16	2 – 9	Resistance of idle contact	Detach control-unit plug from ignition control unit. Acc. pedal not depressed:	0...10 Ω
	V				Acc. pedal depressed somewhat:	infinity Ω
10	|	16	2 – 9	Resistance of charge-air pressure switch	Completely depress acc. pedal:	infinity Ω
	V				Additionally apply 1.5 bar (gauge) to charge-air pressure switch:	0...10 Ω
10	|	17	3 – 9	Resistance of full-load output of ignition control unit, term. 18	Re-attach control-unit plug at ignition control unit.	1,5... 2,5 k Ω
11	|	18	12 – 9	Resistance of parallel solenoid-operated injec. valves with series resistors	+15...+30°C :	5,0...7,50 Ω
	V				approx. +80°C :	5,1...7,75 Ω

N o t e : The following components with the associated connecting leads are not covered by the universal test adapter in the rapid diagnosis chart:

1. Auxiliary-air device
2. Start valve
3. Thermo-time switch
4. Control relay
5. Electric fuel pump
6. Pre-supply pump
7. Lambda-sensor heater
8. Sensor lead
9. Tank ventilation relay
10. Temperature switch +60°C
11. tv-encoding
12. Tank ventilation valve
13. Enrichment signal
14. Diode (overrun cutoff)

TEST SPECIFICATIONS

Component/function	Set values
Electric fuel pump	
* Delivery at return line:	min. 750 cm ^{3} /30 s
* Supply voltage under load:	min. 12 V
* Delivery of pre-supply pump:	min. 850 cm ^{3} /30 s
Pressure regulator	
* Fuel pressure with engine not running:	2,3...2,7 bar
at idle:	Approx. 0.5 bar less
Fuel system, leakage	
* Fuel pressure after engine stopped for 20 min.:	min. 1.0 bar
Auxiliary-air device	
* Resistance	20...55 Ω
Air-flow sensor	
* Resistance between	
term. 8 and term. 5:	340 ... 450 Ω
term. 7 and term. 5:	60 ...1000 Ω 1)
term. 9 and term. 5:	500 ... 760 Ω
term. 8 and term. 9:	160 ... 300 Ω

1) (Deflect air-flow sensor flap as far as it will go)

Component/function	Set values
Temperature sensor (engine)	
* Internal resistance at ambient temperature +15...+30°C:	1,45...3,3 k Ω
With engine at operating temperature approx. + 80°C:	280...360 Ω

TEST SPECIFICATIONS (continued)

Component/function	Set values
Solenoid-operated injection valve	
* Internal resistance at ambient temperature +15...+30°C:	2,0... 3,0 Ω
* Leakage after 60s:	No droplets may drip off
Series resistor	
* Resistance:	5,0... 7,0 Ω
Pressure sensor (altitude sensor)	
* Altitude 300 m (977 mbar):	2,0... 4,0 V
Altitude 4000 m (616 mbar):	8,0...12,0 V
Resistance between term. 2 (-) and term. 3 (+):	2,3... 2,5 k Ω
Charge-air pressure switch	
* Resistance at atmospheric pressure:	infinity Ω
at 1.2...1.5 bar (gauge):	Approx. 0 Ω

Thermo-time switch		
* Internal resistance between:	Below +30°C	Above +40°C
term. G and ground:	25...40 Ω	50... 80 Ω
term. W and ground:	0 Ω	100...160 Ω
term. G and term. W:	25...40 Ω	50... 80 Ω

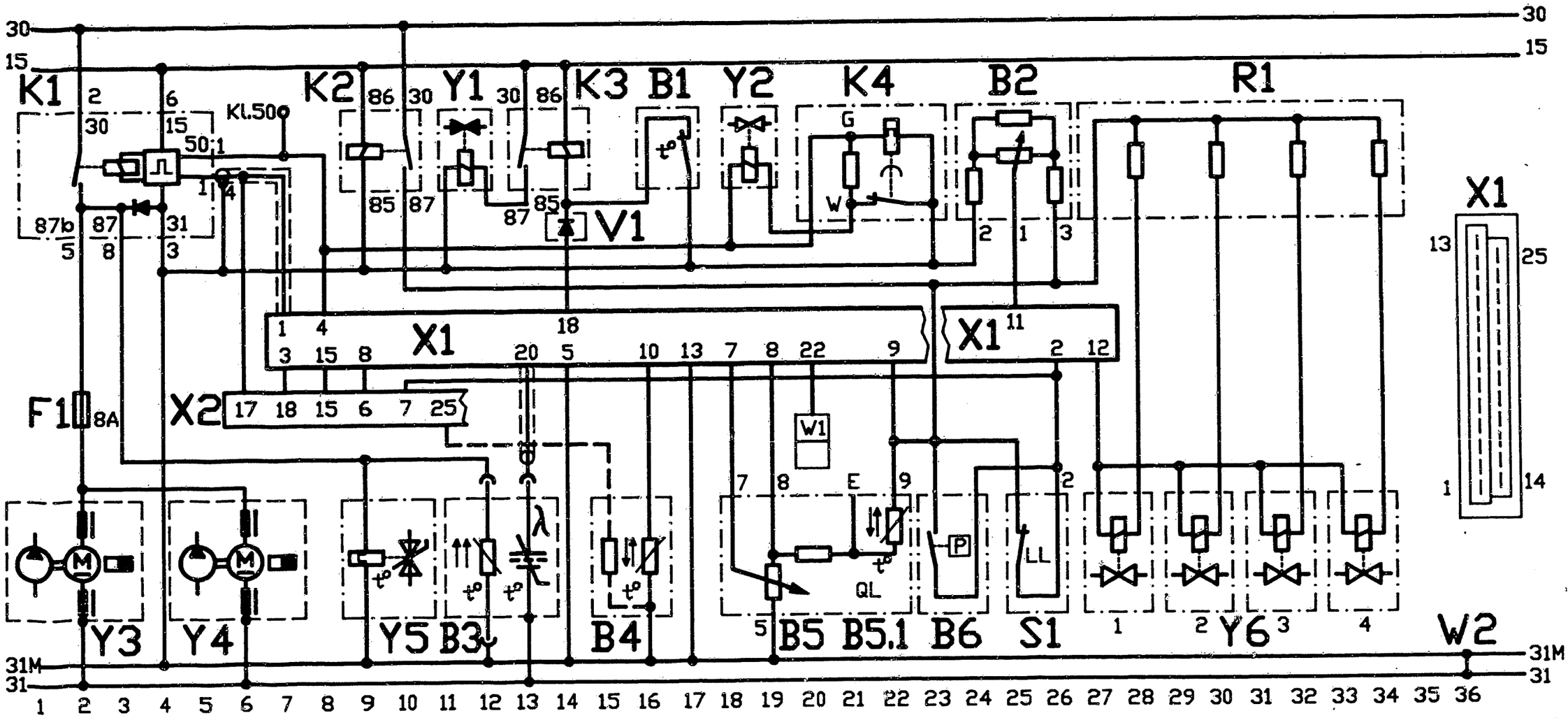
Start valve	
* Internal resistance:	3,5...4,5 Ω
* Leakage, max. perm.:	1 droplets/min.
Tank ventilation valve	
* Resistance	35...55 Ω

TEST SPECIFICATIONS (continued)

Component/function	Set values
Idle-speed adjustment Engine at operating temperature, approx. +80°C	
* Idle speed	
Manual transmission:	850... 950 min $^{-1}$
Automatic transmission:	900...1000 min $^{-1}$
Lambda-sensor heater	
* Internal resistance (PTC) with engine not running:	1... 15 Ω
CO adjustment Engine operating temperature, approx. +80°C	Integrator voltage (Test pin, term. 22)
* Open-loop control (disconnect plug connection of sensor lead):	Fixed voltage value between 5...9 V
* Closed-loop control (fit plug connection together):	Reading fluctuates between 2 voltage values
* Adjustment:	Mean value for closed-loop control same as open-loop value
* Rich value (disconnect plug connection and connect control-unit lead to ground):	10...13 V
* Lean value (apply 2 V to control-unit lead):	Less than 1.0 V

Please refer to equipment and Autodata microcard for settings as regards ignition, valve clearance and other engine-related data.

For production reasons: continued on the following coordinate.



S2801513

B1 = Temperature switch +60°C
B2 = Pressure sensor (altitude sensor)
B3 = Heated lambda sensor
B4 = Temperature sensor (engine); twin version as of 11/86
B5 = Air-flow sensor
B5/1 = Temperature sensor (intake air)
B6 = Charge-air pressure switch
F1 = Fuse (electric fuel pumps)

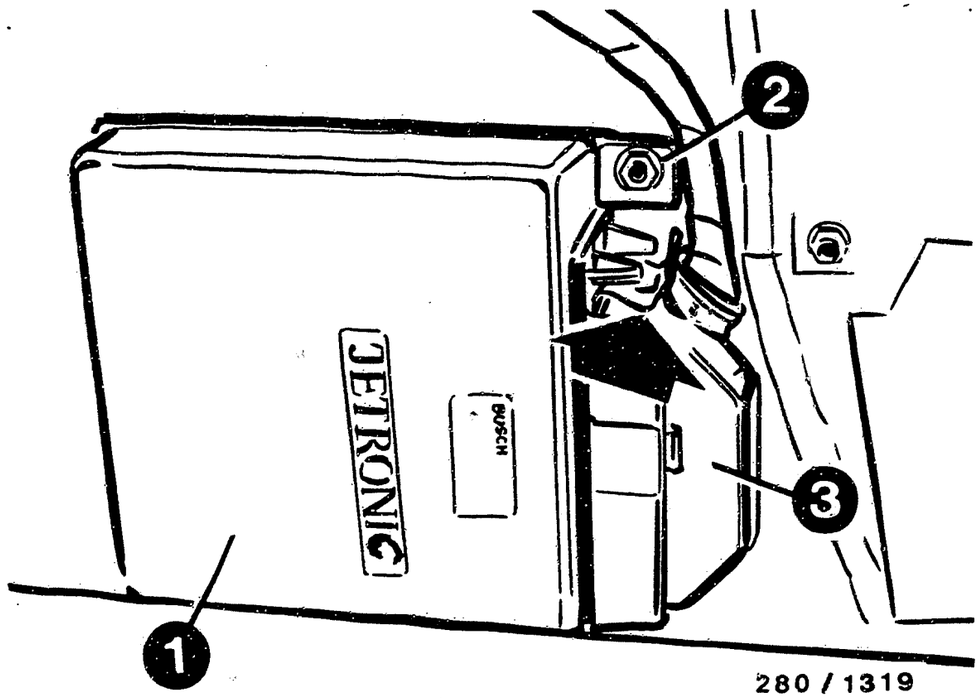
K1 = Control relay
K2 = Auxiliary relay
K3 = Tank ventilation relay
K4 = Thermo-time switch
R1 = Series resistors
S1 = Throttle-valve switch
V1 = Diode (overrun cutoff)
W1 = Test pin (integrator voltage)
W2 = Auxiliary-air device

X1 = Control-unit plug (injection)
X2 = Control-unit plug (ignition)
Y1 = Tank ventilation valve
Y2 = Start valve
Y3 = Electric fuel pump
Y4 = Pre-supply pump
Y5 = Auxiliary-air device
Y6 = Solenoid-operated injection valves

ELECTRICAL TERMINAL DIAGRAM

N13 ⟹

N14 ⟸



280 / 1319

1 = Control unit
2 = Fastening screws
3 = 25-pin control-unit plug

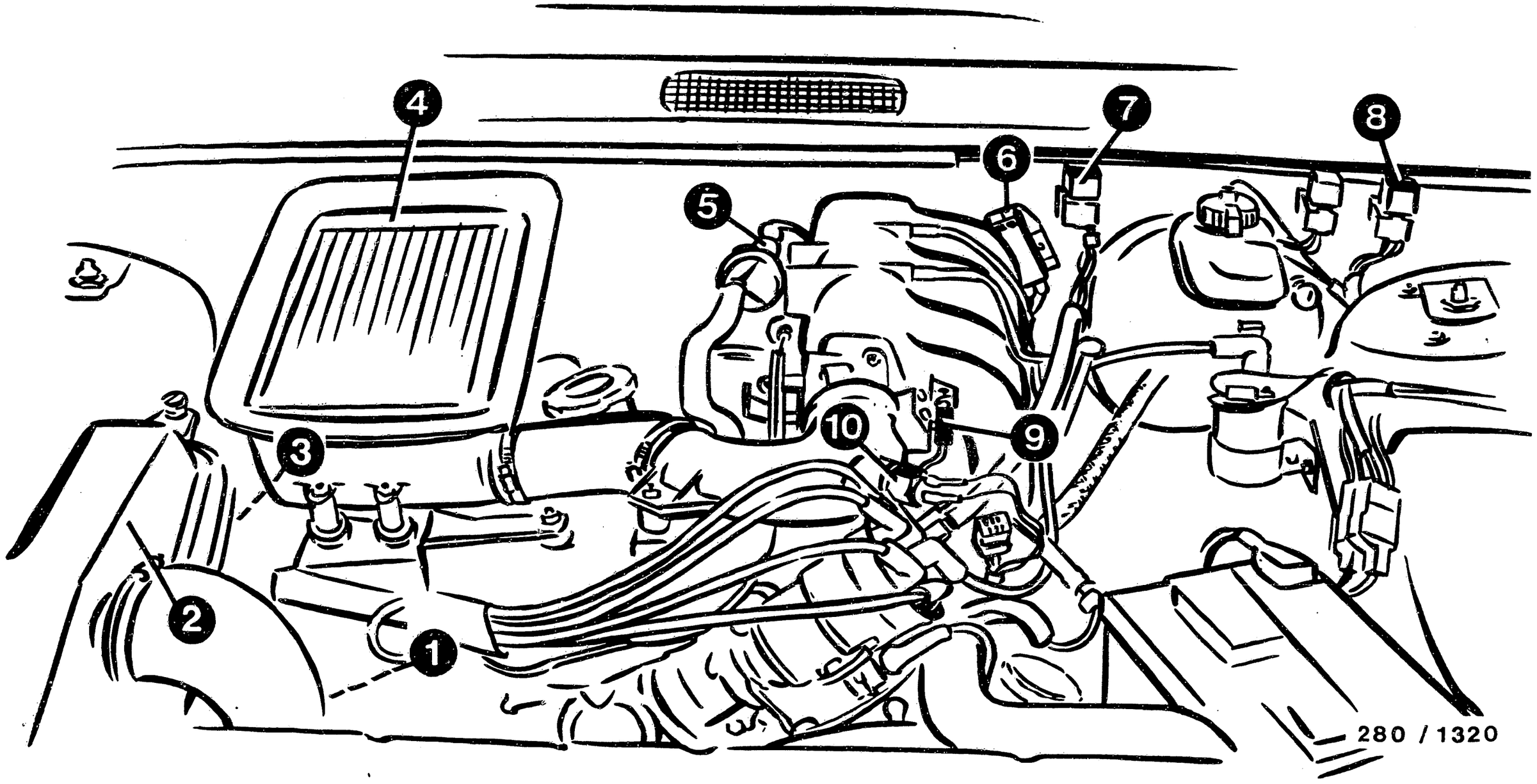
INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

* Control unit:
  The control unit is positioned in the passenger compartment, passenger's side, behind the glove compartment.

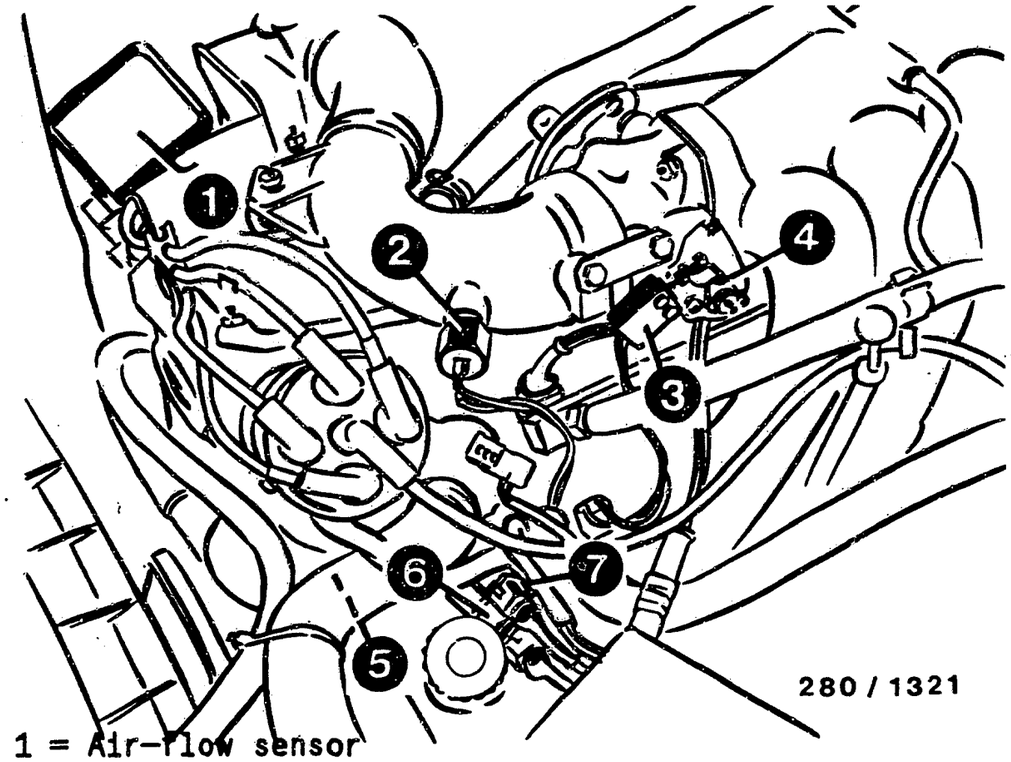
  To connect the universal test adapter, disconnect control-unit plug (25-pin). To do this, push latch in direction of arrow.

For production reasons:
continued on the following coordinate.



1 = To air-flow sensor
2 = Air filter
3 = To pressure sensor (altitude sensor)
4 = Intercooler
5 = Auxiliary-air device
6 = Series resistors
7 = Tank ventilation relay
8 = Auxiliary relay
9 = Throttle-valve switch (idle) and potentiometer
10 = Charge-air-pressure switch

INSTALLATION POSITION OF COMPONENTS (CONTINUED)



1 = Air-flow sensor
2 = Charge-air pressure switch
3 = Throttle-valve idle switch
4 = Potentiometer
5 = to temperature switch +60°C
6 = Thermo-time switch
7 = Temperature sensor (engine); twin version as of 11/86

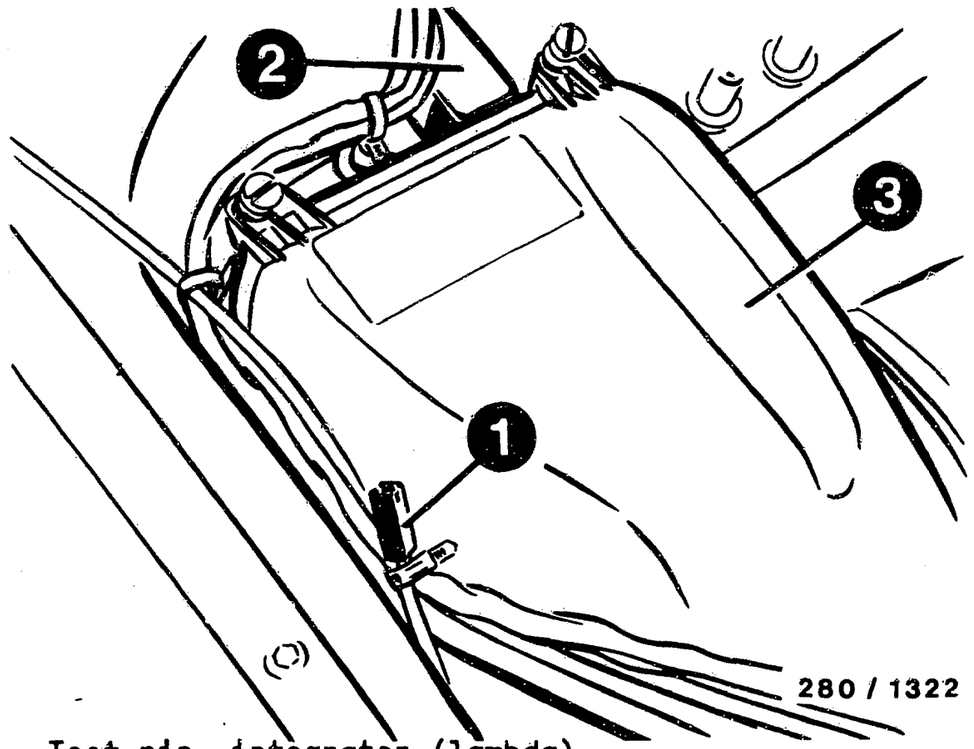
INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Start valve: Beneath intake manifold.

* Central ground: On right of bulkhead, behind cover plate.

* Tank ventilation valve: In vicinity of battery, beneath active-carbon container.

* Diode (overrun cutoff): Behind bulkhead, at windscreen-wiper level.



1 = Test pin, integrator (lambda)
2 = Pressure sensor (altitude sensor)
3 = Air filter

INSTALLATION POSITION OF COMPONENTS (CONTINUED)

* Control relay: On left beneath instrument panel.

* Control unit of EI-K ignition: Beneath footwell trim on passenger side.

* Lambda sensor: Screwed into exhaust pipe ahead of right-hand bulkhead.

* Electric fuel pump: On left ahead of rear axle.

* In-tank pre-supply pump: Accessible via central closure in trunk.